FLOOD INSURANCE STUDY

BRAZORIA COUNTY, TEXAS AND INCORPORATED AREAS

VOLUME 1 OF 2

COMMUNITY NAME	COMMUNITY NUMBER
ALVIN, CITY OF	485451
ANGLETON, CITY OF	480064
BAILEY'S PRAIRIE, VILLAGE OF	480065
BONNEY, VILLAGE OF	481300
BRAZORIA, CITY OF	480066
BROOKSIDE VILLAGE, CITY OF	480067
CLUTE, CITY OF	480068
DANBURY, CITY OF	480069
FREEPORT, CITY OF	485467
HILLCREST VILLAGE, CITY OF	485478
HOLIDAY LAKES, TOWN OF	485517
IOWA COLONY, CITY OF	481071
JONES CREEK, VILLAGE OF	480072
LAKE JACKSON, CITY OF	485484
LIVERPOOL, CITY OF	480075
MANVEL, CITY OF	480076
OYSTER CREEK, VILLAGE OF	481255
PEARLAND, CITY OF	480077
QUINTANA, VILLAGE OF	481301
RICHWOOD, CITY OF	485502
SURFSIDE BEACH, VILLAGE OF	481288
SWEENY, CITY OF	485512
UNINCORPORATED AREAS	485458
WEST COLUMBIA, CITY OF	480081

JUNE 5, 1989

Federal Emergency Management Agency

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
BRAZORIA COUNTY AND INCORPORATED AREAS, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates previous Flood Insurance Studies/Flood Insurance Rate Maps for the geographic area of Brazoria County, Texas, including: the unincorporated areas of Brazoria County; the Cities of Alvin, Angleton, Brazoria, Brookside Village, Clute, Danbury, Freeport, Hillcrest Village, Lake Jackson, Liverpool, Manvel, Pearland, Richwood, Sweeny, West Columbia, and Iowa Colony; and the Villages of Bailey's Prairie, Bonney, Jones Creek, Oyster Creek, Quintana, and Surfside Beach (hereinafter referred to collectively as Brazoria County). In addition, this study includes a Flood Insurance Study for the Town of Holiday Lakes, whose flood hazard information was previously contained in the Brazoria County Flood Insurance Study (unincorporated areas) and Flood Insurance Rate Map (FIRM). This information will be used by Brazoria County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP). The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This revision was prepared to include incorporated communities within Brazoria County into a countywide Flood Insurance Study. Those incorporated communities were shown as Areas Not Included (ANI) in the August 19, 1986 Flood Insurance Study for the unincorporated areas of Brazoria County. Information on the authority and acknowledgments for each of these studies compiled from their effective narratives is shown below:

Unincorporated Areas of Brazoria County:	The hydrologic and hydraulic analyses in the original study were prepared by Michael Baker, Jr., for the Federal Emergency Management Agency (FEMA). This work was completed in 1976.

In a revision effective August 19, 1986, the hydrologic and hydraulic analyses for the sources studied by detailed methods, except the hydrologic and hydraulic analyses for Clear Creek and the hydrologic analysis for the Brazos River, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787; this work was completed in January 1983. The hydrologic and hydraulic analyses for Clear Creek were performed by the Harris County Flood Control District (HCFCD); this work was completed in January 1984. The hydrologic analysis for the Brazos River was prepared by Espey, Huston, & Associates; this work was completed in December 1985 and was used in the hydraulic analysis prepared by Woodward-Clyde Consultants.

City of Alvin:

The hydrologic and hydraulic analyses for the study effective July 19, 1982, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in December 1980.

The revision effective July 16, 1987, reflects annexations by the City of Alvin from the unincorporated areas of Brazoria County.

City of Angleton:

The hydrologic and hydraulic analyses for the study effective July 5, 1982, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in February 1981.

Village of Bailey's Prairie:

The hydrologic and hydraulic analyses for the study effective December 15, 1983, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in June 1981.

Village of Bonney:	The hydrologic and hydraulic analyses for the study effective March 15, 1984, were prepared by Woodward-Clyde Consultants during the preparation of the Flood Insurance Study for the unincorporated areas of Brazoria County.
City of Brazoria:	The hydrologic and hydraulic analyses for the study effective December 15, 1983, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in June 1981.
City of Brookside Village:	The hydrologic and hydraulic analyses for the study effective November 1, 1984, were prepared by Bernard Johnson Incorporated for FEMA. This work was completed in May 1982. In a revision effective November 15, 1985, the hydrologic and hydraulic analyses for Clear Creek were prepared by the HCFCD; this work was completed in January 1984.
City of Clute:	The hydrologic and hydraulic analyses for the study effective December 7, 1976, were prepared by Turner, Collie, and Braden, Inc., Consulting Engineers, for FEMA. In a revision effective December 1, 1983, the hydrologic and hydraulic analyses for Oyster Creek were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in October 1981.
City of Danbury:	The hydrologic and hydraulic analyses for the study effective September 16, 1981, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in July 1980.

City of Freeport:

The community's FIRM became effective on November 17, 1970. The hydrologic and hydraulic analyses for a revision effective October 31, 1975 were prepared by Michael Baker, Jr.

In a revision effective January 17, 1986, the hydrologic and hydraulic analyses were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in January 1983.

City of Hillcrest Village:

The hydrologic and hydraulic analyses for the study effective July 19, 1982, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in December 1980.

City of Iowa Colony:

The hydrologic and hydraulic analyses for the study effective May 17, 1982, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in August 1980.

The revision effective August 19, 1986, reflects annexations by the City of Iowa Colony from the unincorporated areas of Brazoria County.

Village of Jones Creek:

The hydrologic and hydraulic analyses for the study effective June 5, 1985, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in February 1983.

City of Lake Jackson:

The hydrologic and hydraulic analyses for the study effective July 3, 1985, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in October 1981.

City of Liverpool:

The hydrologic and hydraulic analyses for the study effective June 5, 1985, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in September 1982.

City of Manvel:	The hydrologic and hydraulic analyses for the study effective December 1, 1981, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in December 1980.
City of Pearland:	The hydrologic and hydraulic analyses for the study effective July 5, 1984 for Clear Creek were prepared by Dewberry & Davis. This work was completed in June 1983. The hydrologic and hydraulic analyses for Marys Creek and Marys Creek By-Pass Channel were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in June 1981.
Village of Oyster Creek:	The hydrologic and hydraulic analyses for the FIRM effective November 19, 1976 were prepared by Michael Baker, Jr. and completed in September 1976.
Village of Quintana:	The hydrologic and hydraulic analyses for the study effective June 5, 1985, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in January 1983.
City of Richwood:	The hydrologic and hydraulic analyses for the study effective July 28, 1972, were prepared by the U. S. Geological Survey (USGS) for FEMA, under Inter-Agency Agreement No. IAA-H-17-72. In a revision effective April 3, 1985, the hydrologic and hydraulic analyses for Oyster Creek and Bastrop Bayou were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in 1981.
Village of Surfside Beach:	The hydrologic and hydraulic analyses for the study effective June 5, 1985, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in January 1983.
City of Sweeny:	The hydrologic and hydraulic analyses for the study effective December 1, 1982, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in June 1980.

City of West Columbia: The hydrologic and hydraulic analyses for the study effective December 15, 1983, were prepared by Woodward-Clyde Consultants for FEMA, under Contract No. H-4787. This work was completed in November 1981.

In this revision, the hydraulic analyses for the Brazos River, Bastrop Bayou, Brushy Bayou, Cedar Lake Creek, Cocklebur Slough, Halls Bayou, Oyster Creek, and the San Bernard River, as well as the hydrologic analyses for the Brazos River and Oyster Creek were prepared by the Galveston District of the U. S. Army Corps of Engineers (COE) for FEMA, under Inter-Agency Agreement No. EMW-84-E-1506, Project Order No. 1. This work was completed in October 1986. The hydraulic analyses for Clear Creek in the City of Brookside Village and the City of Pearland were prepared by the Harris County Flood Control District (HCFCD) and were completed in December 1984. In addition, further hydraulic analyses of the San Bernard River were prepared by the COE for FEMA under the Limited Map Maintenance Program; this work was completed in October 1987.

1.3 Coordination

The dates of the initial and final Consultation and Coordination Officer's (CCO) meetings held for Brazoria County and the incorporated communities within its boundaries, including the portions of the City of Pearland within Harris County, are shown in the following tabulation:

Community Name	Initial CCO Date	Final CCO Date
Unincorporated Areas of Brazoria County	September 1978	January 29, 1988
City of Alvin	May 1978	June 11, 1981
City of Angleton	May 1978	August 3, 1981
Village of Bailey's Prairie	May 1978	June 22, 1988
Village of Bonney	*	June 15, 1988
City of Brazoria	May 1978	June 21, 1988
City of Brookside Village	May 1978	October 26, 1982
City of Clute	May 1978	October 26, 1982
City of Danbury	May 1978	September 30, 1980
City of Freeport	September 1978	June 16, 1988
City of Hillcrest Village	May 1978	June 11, 1981
Town of Holiday Lakes	*	June 15, 1988
City of Iowa Colony	May 1978	May 28, 1981
Village of Jones Creek	May 1978	June 13, 1984
City of Lake Jackson	May 1978	June 20, 1988
City of Liverpool	May 1978	June 13, 1984
City of Manvel	May 1978	May 28, 1981
Village of Oyster Creek	*	June 17, 1988
City of Pearland	May 1978	October 18, 1982
Village of Quintana	September 1978	June 14, 1984
City of Richwood	May 1978	October 26, 1982
Village of Surfside Beach	September 1978	June 13, 1984
City of Sweeny	May 1978	June 22, 1988
City of West Columbia	May 1978	June 21, 1988

*Data not available

The initial CCO meetings were held with representatives of FEMA, the community, and the study contractor to explain the nature and purpose of Flood Insurance Studies and to identify the streams to be studied by detailed methods.

For the Flood Insurance Studies for the unincorporated areas of Brazoria County, the City of Freeport, the Village of Quintana, and the Village of Surfside Beach, legal notices that announced the inception and objectives of the studies were placed in the local newspaper for a period of three weeks. Coordination in the development of these studies was obtained through the Bureau of Economic Geology, the City and Village of Freeport, the Village of Jones Creek, the Village of Oyster Creek, Brazoria County, Brazosport Chamber of Commerce, the National Oceanic and Atmospheric Administration, the Texas Highway Department, the Texas State Department of Water Resources, the Galveston District of the COE, the USGS, and the U. S. Soil Conservation Service (SCS). The State Coordinator was involved with these studies through the Dallas Regional Office of FEMA.

The final CCO meetings were held with representatives of FEMA, the community, and the study contractor to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the geographic area of Brazoria County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

Table 1, "Scope of Study", lists all riverine flooding sources studied by detailed methods and lists the areas studied.

TABLE 1 - SCOPE OF STUDY

Stream	Downstream Limit	Upstream Limit
Austin Bayou	Confluence with Bastrop Bayou, Mile 0.0	Mile 27.5
Bastrop Bayou	Mile 4.0	Confluence of East and West Tributaries, Mile 21.7
Bastrop Bayou West Tributary	Confluence with Bastrop Bayou, Mile 21.7	Mile 24.9
Bastrop Bayou East Tributary	Confluence with Bastrop Bayou, Mile 21.7	Mile 26.9
Bell Creek	Confluence with San Bernard River, Mile 0.0	Mile 5.3

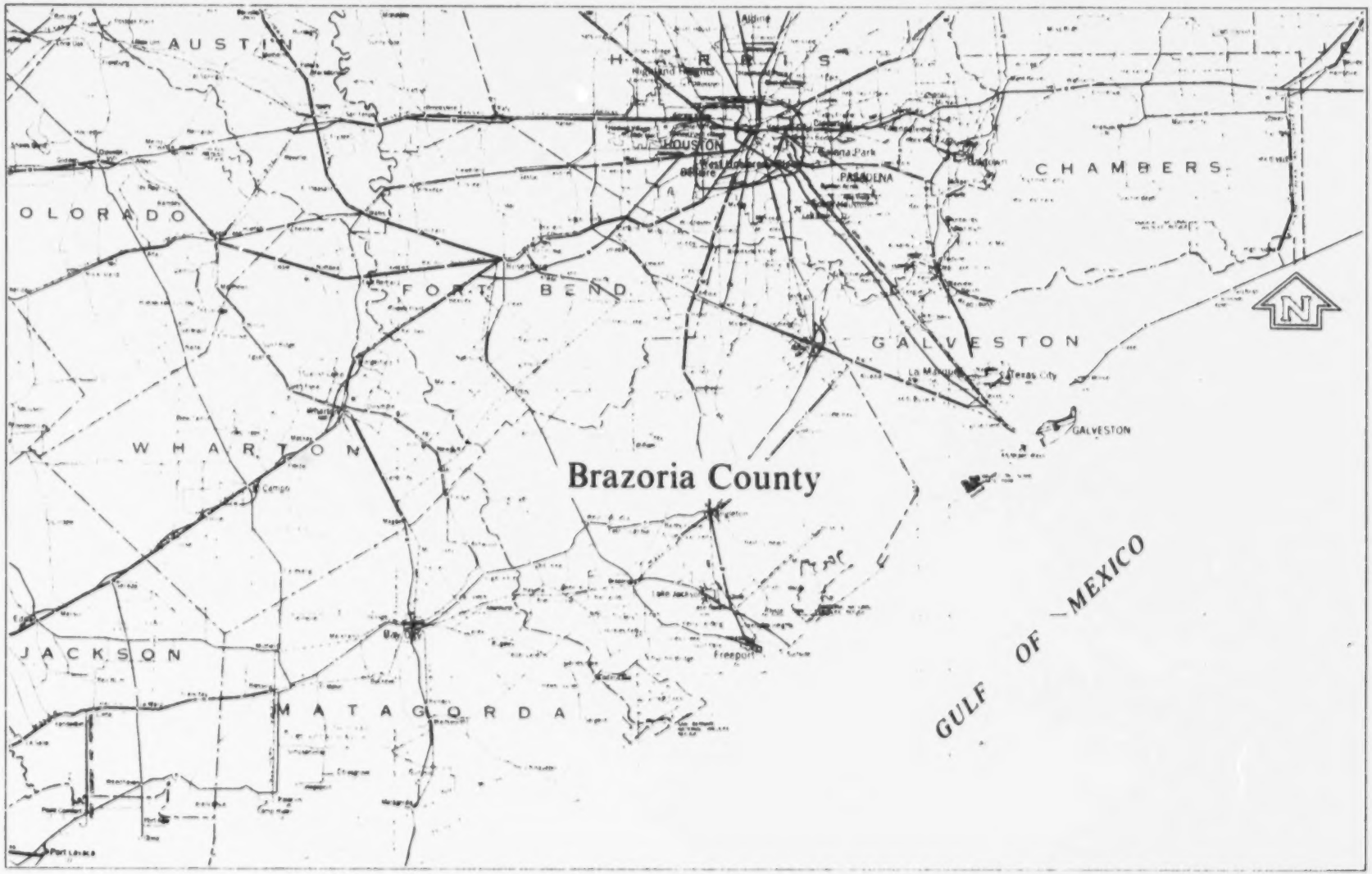


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX

AND INCORPORATED AREAS

APPROXIMATE SCALE

48 0 16 32 48 MILES

VICINITY MAP

TABLE 1 - SCOPE OF STUDY - continued

Stream	Downstream Limit	Upstream Limit
Brazos River	Mile 4.4	Mile 65.8
Brushy Bayou		
Lower Reach (LR)		
Upper Reach (UR)	LR, confluence with Austin Bayou, Mile 0.0	LR Mile 4.3
	UR, County Route 210, Mile 5.0	UR Mile 10.5
Cedar Lake Creek	Approximately 12,700 feet downstream of FM2611, Mile 7.6	Mile 17.3
Chocolate Bayou	Approximately 9,000 feet upstream of FM2004, Mile 1.7	Mile 34.8
Clear Creek	Mile 26.6	Mile 45.7
Cocklebur Slough	Confluence with Cedar Lake Creek, Mile 0.0	Mile 14.7
Cow Creek	Confluence with Brazos River, Mile 0.0	Mile 8.2
Flores Bayou	Confluence with Austin Bayou, Mile 0.0	Mile 10.6
Halls Bayou	Mile 9.6	Mile 18.8
Hayes Creek	Confluence with Chocolate Bayou, Mile 0.0	Mile 7.1
Linnville Bayou	Mile 6.6	Mile 26.2
Marys Creek	Mile 2.1	Mile 11.2
Marys Creek By-Pass Channel	County boundary, Mile 0.4	At divergence from Marys Creek, Mile 2.3
Mound Creek	Confluence with San Bernard River, Mile 0.0	Mile 8.9
Mustang Bayou	Approximately 5,000 feet downstream of FM2004, Mile 6.6	Mile 41.8
Oyster Creek	At FM523, Mile 4.5	Mile 82.8
San Bernard River	Confluence of Intercoastal Waterway, Mile 0.0	Mile 49.2
Stevenson Slough	Confluence with San Bernard River, Mile 0.0	Mile 5.4
Unnamed Tributary to Chocolate Bayou	Confluence with Chocolate Bayou, Mile 0.0	Mile 5.8
Varner Creek	Confluence with Brazos River, Mile 0.0	Mile 11.7
West Fork Chocolate Bayou	Confluence with Chocolate Bayou, Mile 0.0	Mile 9.6

Areas of shallow flooding in the City of Brazoria southeast of the intersection of Alabama Street and Oak Street, and west of the intersection of FM 521 and State Route 36 were studied by detailed

methods. These areas were determined based on actual flood observations, and the source of flooding may be due, in part, to inadequate storm drainage. Tidal flooding including its wave action was studied by detailed methods along the Gulf of Mexico and West Bay. In addition, floods caused by the overflow of Stevenson Slough in the western corner of the City of Sweeny extending downstream through the central part of the city and east to the corporate limits were studied by detailed methods.

On Flood Insurance Rate Map (FIRM) panels 735, 745, 755, 765, and 770, riverine flooding from the San Bernard River affects an area away from the river channel and south of the Village of Jones Creek; the area of the San Bernard River channel itself is controlled by tidal flooding.

In this revision, the following streams were updated: the Brazos River, for its entire riverine portion within the county; Brushy Bayou, from Mile 0.6 to Mile 4.3; Cocklebur Slough, from Mile 3.2 to Mile 4.5; Oyster Creek, for its entire riverine portion within the county; the San Bernard River, for its entire riverine portion within the county (100- and 500-year floods only); and Clear Creek, from Mile 26.6 to Mile 39.3. Floodways computed by the COE were added in tidally-controlled areas for Bastrop Bayou, Cedar Lake Creek, Cocklebur Slough, Halls Bayou, Oyster Creek, and the San Bernard River; floodways computed by the COE were added to riverine areas for the Brazos River, Brushy Bayou downstream of Mile 4.3, Cocklebur Slough downstream of Mile 4.5, Oyster Creek, and the San Bernard River. In addition, floodways computed by HCFCD for Clear Creek and by Woodward-Clyde Consultants for the remaining floodways were added in this revision. Depth criteria were added for portions of the Brazos River, Oyster Creek, and the San Bernard River. Furthermore, the change in flooding effects from the Brazos River is reflected on the profile for Varner Creek. Flooding effects from the Brazos River have been removed from the profile for Cow Creek since precise water-surface elevation data are not available for an area near the confluence of these two streams. The change in flooding effects from the San Bernard River is reflected on the profiles for Bell Creek, Mound Creek, and Stevenson Slough. Minor adjustments were made to the flood hazard boundaries to achieve a match between communities; tidal flooding within the Village of Oyster Creek, which did not match the surrounding area, was deleted.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

Portions of Austin Bayou, Bell Creek, Brushy Bayou, Cedar Lake Creek, Chocolate Bayou, Cocklebur Slough, Cow Creek, Flores Bayou, Linnville Bayou, Mound Creek, Mustang Bayou, San Bernard River, Stevenson Slough, and Varner Creek were studied by approximate methods. Cedar Creek, Chigger Creek, Cowart Creek, Dance Bayou, Eagle Nest Lake, Little Linnville Bayou, Manor Lake, and numerous unnamed creeks and ditches were also studied by approximate methods.

An approximate analysis on flooding due to rainfall for areas of the City of Freeport that are protected by the Freeport levee system was also included in this study. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and Brazoria County.

In some instances, such as for the City of Angleton, floodplain boundaries continue only to the corporate limits. This is because the original study of flood hazards in these communities was limited to flood hazards within the community itself and was not continued into the unincorporated areas of Brazoria County.

2.2 Community Description

Brazoria County is part of the flat, rich coastal plain of southeastern Texas. It has a land area of approximately 1,423 square miles. Brazoria County is bordered by Galveston County to the east, Harris County to the north, Fort Bend and Matagorda Counties to the west, and the Gulf of Mexico and West Bay to the south.

The 1980 population of Brazoria County was 167,258 (Reference 1). Phenomenal growth has been experienced in this community since 1940 due to the expansion of the Houston metroplex and the increased chemical and offshore industries.

Major communities within the area are the Cities of Alvin, Danbury, Angleton, Pearland, Sweeny, and Brazosport. Municipalities in Brazosport include Brazoria, Clute, Freeport, Jones Creek, Lake Jackson, Oyster Creek, Quintana, Richwood, and Surfside Beach. Brazosport is primarily industrial and is the population center of Brazoria County. Major natural resources of the area include natural gas, oil, oyster shells, and shrimp.

The Brazos River watershed extends in a southeastern direction from the high plains of eastern New Mexico across Texas to the Gulf of Mexico at Freeport. The watershed is approximately 640 miles long, with drainage areas of approximately 1,800 square miles in New Mexico and 42,800 square miles in Texas. The drainage area below Possum Kingdom Dam has the greatest significance with regard to the portion of the Brazos River affecting Brazoria County. Reservoirs with significant flood control storage in this drainage area are Whitney, Waco, Belton, Proctor, Stillhouse Hollow, Somerville, Granger, and North Fork.

The Oyster Creek watershed extends in a southern direction from Waller County to the Gulf of Mexico at Freeport. The watershed has a drainage area of approximately 250 square miles.

The Brazos River watershed has a relatively moderate climate during most of the year. The climate in Brazoria County during the summer is moderated by the prevailing cool southeasterly winds from the Gulf. Summers are long with high daytime and moderate nighttime temperatures; the average annual temperature ranges from the 70's (degrees Fahrenheit) in the coastal region to the high 50's in the upper portion of the Brazos River watershed. Normally, the winters are short and comparatively mild; the average minimum January temperature varies from the low 40's near the coast to the low 20's near the headwaters. During December, January, and February, the winds are generally northerly, but during the balance of the year southerly winds predominate.

Rainfall in the Brazos River basin varies widely in both seasonal occurrence and yearly mean depth. The mean annual precipitation is approximately 27.6 inches, varying from approximately 16 inches near the headwaters to 47 inches in the coastal region. Based on Waco runoff records, the year of greatest drought was 1917, when the average basin rainfall was only approximately 15 inches. Snowfall in the lower reaches of the Brazos River is rare and makes no significant contribution to runoff. Thunderstorms are common throughout the spring, summer, and fall. Frequent hurricanes and tropical storms interrupt summer with high winds, heavy rainfall, and high storm surges.

The topography in Brazoria County is flat, with the Brazos River and Oyster Creek following a sinuous course. The overbank areas are generally obstructed by trees and brush. Man-made obstructions to flow include levees, highways, railroads, and irrigation canals. There is a large amount of interbasin flow exchange between the Brazos River and Oyster Creek basins. The larger floods on Oyster Creek are due to overflow from the Brazos River. There is significant overflow out of the Brazos River and Oyster Creek basins into Bastrop Bayou and Jones Creek and, to a lesser degree, Austin and Flores Bayous.

2.3 Principal Flood Problems

The history of flooding within Brazoria County indicates that flooding may occur during any season of the year. Riverine flooding results primarily from overflow of the streams caused by rainfall runoff, ponding, and sheet flow. Storms occurring during the summer months are often associated with tropical storms moving inland from the Gulf of Mexico.

Thunderstorms are common throughout the spring, summer, and fall months. The frequent hurricanes and tropical storms interrupt the summer with high winds, heavy rainfalls, and high storm surges. Flooding in Brazoria County results primarily from tidal surges from the hurricanes and tropical storms. The amount of flooding generated for any given storm or hurricane is dependent on the characteristics and location of the storm. The following brief

descriptions of several significant storms provide historic information to which coastal flood hazards and projected flood depths can be compared (References 2, 3, 4, 5, 6, 7, 8, and 9).

The hurricane of August 5-23, 1915, which had a radius of 32 miles, reached land near the mouth of the Brazos River. Maximum winds were reported to be 120 miles per hour (m.p.h.), and maximum tides were reported at various elevations ranging from 10.4 feet to 14 feet. It was estimated that crests of breaking waves reached heights of 21 feet at the Galveston seawall. Great quantities of water were thrown over the seawall, and scour of pavement and building foundations caused extensive damage. This storm caused 275 deaths and a total of $56 million in damage.

The hurricane of August 30-31, 1942, was first discovered in the western portion of the Atlantic Ocean near the Windward Islands. It gained strength as it proceeded across the Caribbean Sea, and then was classified as a hurricane. The eye of the hurricane moved across Matagorda Island and passed over Seadrift as it moved inland. Maximum winds were estimated at 115 m.p.h., and hurricane winds covered a diameter of 150 miles on the coastline. The maximum tide height reported was 14.7 feet at Matagorda (with reports of 11.8 feet at Freeport). Total damage for the hurricane amounted to $26.5 million, with $11.5 million in property damage and the rest in crop damage.

In August 1945, a tropical depression was first reported in the southwestern portion of the Gulf of Mexico, moving steadily north. It intensified to a hurricane as it moved toward the shore and tracked along the shoreline before finally moving across San Jose Island in the vicinity of Cedar Bay Pass. This severe hurricane affected a fairly wide area and caused extensive damage to property and crops between Corpus Christi and Houston. Maximum wind speeds occurring between Port Aransas and Matagorda were estimated at 100 to 135 m.p.h. Water levels between 6.6 feet and 14.5 feet were generated in the Matagorda Bay and Lavaca Bay area. The hurricane caused extensive beach erosion throughout the affected area and severely eroded the western Matagorda Bay shores. Several miles of shoreline receded 50 feet as a result of the hurricane. Total damage was estimated at over $20 million.

The storm of October 2-3, 1949, originated in the Pacific Ocean near El Salvador, crossed Guatemala, moved north across the Gulf of Mexico, and reached land near Freeport. Maximum winds at Freeport were 135 m.p.h., and tide levels were more than 11 feet. Property damage was $7 million, and the Texas rice crop was damaged to the extent of approximately $5 million.

Hurricane Carla, which hit the Texas coast on September 11, 1961, originated in the Caribbean Sea, and when it passed through the Yucatan Peninsula, the storm already had winds of 110 m.p.h. The large, unusually slow-moving hurricane strengthened, with its

cyclonic winds covering the entire Gulf of Mexico. Carla moved inland near the Port O'Connor-Port Lavaca area. Maximum sustained wind velocities at Port Lavaca were estimated at 115 m.p.h. High-water marks indicate tide heights reached elevations of up to 22 feet at Port Lavaca as the storm swept across the barrier islands. The highest recorded elevations along the open coast were approximately 12.3 feet. This hurricane also spawned a rash of 26 tornadoes which took several lives in Texas and caused extensive damage. Although rainfall accompanying the hurricane was heavy in several local areas, the total volume of precipitation was not unusually high. At Freeport, the 4-day rainfall was approximately 10 inches. Carla is significant because of the large area that was affected and the length of time the abnormal water levels prevailed. This hurricane flooded 402 square miles of Brazoria County, approximately 28 percent of the total land in the county. The total damage to the county was estimated at $75,001,000, of which $39,937,000 was due to tidal overflow.

Hurricane Beulah, which occurred on September 5-22, 1967, began harmlessly as a weak tropical depression east of the Windward Islands. Moving into warm Caribbean waters, the storm intensified to the category of a hurricane. Beulah was disrupted temporarily near Jamaica, then regained intensity and moved inland just east of Brownsville. Torrential rains fell in southern Texas and northeastern Mexico. Rainfall amounts ranged from 10 to 20 inches over much of the area. The total rainfall exceeded 30 inches in some areas. Although considerable damage resulted from strong winds and high tides, the majority of the destruction was due to torrential rains and resultant flooding. Some damage was also caused by tornadoes. Property damage in Brazoria County was minor, but Matagorda County experienced damage of approximately $745,000, and Palacios incurred total damage estimated at $241,000, 77 percent of which was attributable to tornadoes.

Hurricane Celia occurred on July 30-August 5, 1970. It was spawned from a depression which formed in the northwestern Caribbean Sea and crossed the Texas coastline midway between Corpus Christi and Aransas Pass. The highest tide at Matagorda was recorded at 4.1 feet. The hurricane did not produce the torrential rains and massive flooding that often accompany storms of this magnitude. Most of the destruction resulted from high winds, and the destruction in the area resembled the effects of a tornado more than those of a hurricane. Total damage caused by this storm was estimated at $470 million, with wind damage accounting for approximately $440 million of the total. The significance of Hurricane Celia was the extremely high winds, low storm surges, and little rainfall.

The greatest 24-hour rainfall recorded in the United States was 43 inches at Alvin, Texas (Reference 10).

In late July 1979, Tropical Storm Claudette brought 26 inches of rain in a 24-hour period. The severity of this disaster is underscored when compared with the 24-hour rainfalls of 10.8 inches recorded in Houston in 1943 and to the 14.4 inches recorded in Galveston in 1900. Other floods of record occurred in July 1939, October 1949, May 1957, June 1968, and June 1973.

The northern and southern part of the City of Alvin are affected by shallow flooding caused by ponding of runoff during heavy rains. Principal physical features that affect flooding in the southern part of the city are Brisco Canal, which blocks the passage of runoff southward, and its parallel ditch, C-1, which lacks the capacity to channel the runoff southeastward. In the northern part of the city, the movement of water eastward via Dickinson Bayou and its tributaries are slowed by the American Canal System.

A small flooded area in the City of Angleton is caused by overflow from Ditch No. 10 just north of State Route 35. There is also some shallow flooding within the city due to inadequate local drainage facilities.

Flooding along Briscoe Canal in the City of Manvel occurs as the result of ponding of runoff from a relatively large drainage area to the north of the canal and the insufficient conveyance capacity of ditch C-1, which runs parallel to Briscoe Canal.

USGS gaging station No. 08114000 on the Brazos River located in Fort Bend County at U. S. Route 59 in Richmond, Texas, was used in this study. It has a drainage area of 45,007 square miles and a period of record from 1903 to present. A USGS gaging station No. 08077000 exists at the State Route 35 bridge crossing Clear Creek; however, there are no records of flood flows with recurrence intervals greater than 25 years at this gage.

2.4 Flood Protection Measures

A primary flood protection measure in Brazoria County is the Freeport and Vicinity Hurricane Flood Protection system. This system was authorized by the Flood Control Act of October 1962, under which the COE was instructed to rehabilitate, enlarge, and extend the levee system which was sponsored by the federal government and local interests.

The existing levee begins at high ground near Lake Jackson, then extends along the east bank of the Brazos River to the Intracoastal Waterway. Here, it turns east to the Freeport Harbor, encircles the Harbor and the Dow Barge Canal, turns north to Oyster Creek, and follows the west bank of Oyster Creek to high ground in the vicinity of Lake Barbara. The levee is approximately 53 miles long and provides protection to approximately 43 square miles of the Brazosport area. The elevation of the top of this levee varies from 15 to 21 feet. In addition, the Dow Chemical Company has

constructed a levee system that encircles their plants in Brazoria County. These levees that exist in the study area provide the community with some degree of protection against flooding.

The Angleton Levee extends from the Angleton Oil Field along the western flank of the City of Angleton, south to its intersection with Bastrop Bayou. This levee was constructed in the early 1900's to provide protection against flooding from Oyster Creek in the west. The Angleton Drainage District has also constructed conveyance channels and provides protection to the area.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the county.

USGS Report 77-110, Technique for Estimating the Magnitude and Frequency of Floods in Texas, was used to develop the flood discharges for the streams studied by detailed methods in Brazoria County, with the exception of: the Brazos River; the 50-, 100-, and 500-year flood discharges for Oyster Creek downstream of Harris Reservoir; and Clear Creek (Reference 11). Report 77-110 is a regional method based on regression analyses relating drainage area and channel slope to peak discharge by empirical equations developed for six designated regions in Texas.

Flood discharges for Bastrop Bayou upstream of mile 15.7 and Mustang Bayou, generated using USGS Report 77-110, were checked in areas of urbanization using USGS Water Resources Investigations 3-73, Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area, a regional method based on regression analyses (Reference 12). This method relates drainage area and percentage of impervious area to peak discharges by empirical equations developed for the Houston metropolitan area. Since the Alvin, Hillcrest Village, and Lake Jackson areas are geographically close to Houston and similar in drainage basin characteristics, this method was deemed suitable for application in those urbanized areas.

The 10-, 50-, and 100-year discharges for Chocolate Bayou were generated from USGS Report 77-110 . The 500-year discharges were determined by extrapolation of the peak discharge-frequency curve of the flood discharge computed for recurrence intervals up to 100 years. The peak discharges were adjusted based on the peak discharge-frequency estimates made for USGS gage No. 08078000 on FM1462.

The flood discharges for the San Bernard River upstream of mile 16.2, calculated using USGS Report 77-110, were adjusted to reflect a statistical analysis performed at USGS gaging station No. 08117500 near Boling.

The 10-, 50-, 100-, and 500-year discharges for the Brazos River and the 50-, 100-, and 500-year discharges for Oyster Creek downstream of Harris Reservoir were obtained using the FLOW SIM 10 computer program developed by the COE (Reference 13). Initial hydrographs used in the FLOW SIM 10 model were obtained from the Flood Insurance Study for the unincorporated areas of Fort Bend County (Reference 14). In that study, the flood discharges for the Brazos River were determined using a frequency curve developed from data collected at the Richmond, Texas, gaging station in accordance with USGS Bulletin 17B (Reference 15). The initial hydrographs were then routed using the FLOW SIM 10 model and calibrated to the May 1957 flood on the Oyster-Brazos watershed.

FLOW SIM 10 is a two-dimensional modeling program that is especially effective for analyzing interbasin flow in low-lying areas. The program allows flow to be channel confined, using a one-dimensional unsteady flow analysis; without channels, using a totally two-dimensional approach; or a combination of both. The model developed for this study used a combination of both. The model is a series of 2-mile square grids covering the study area, with channels located at the top and right sides of the grids laid out in a best fit approximation. The model is supported by records of maximum stages reached at various locations along the Brazos River for several historical floods; these records were provided by the Brazosport Chamber of Commerce. The discharges computed in the FLOW SIM 10 model were used in a HEC-2 hydraulic model (Reference 16); when the

alignment of the grid cells did not follow the natural slope of the ground, vectors were used to convert the two-dimensional FLOW SIM 10 flow into a one-dimensional HEC-2 flow.

The flood discharges for Clear Creek were determined by the HCFCD using the COE HEC-1 computer program (Reference 17). Clark's unit hydrograph parameters were optimized from a regression analysis evaluating the storm events obtained at various gages in the region. Percent of urbanization and ponding, caused by extensive rice farming in the region were taken into account. The relationship between the percent ponding and attenuation was obtained from the SCS publication Technical Release No. 55, Urban Hydrology for Small Watersheds (Reference 18). Loss rates were estimated using the SCS methodology, incorporating the use of runoff curve numbers, and from soil type (Reference 19). A statistical analysis of the gage data on Clear Creek was not used to obtain the 10-, 50-, 100-, and 500-year peak discharges since past channel rectifications have made the statistical correlation of flood peaks questionable.

The approximate analysis in the City of Freeport for flooding due to rainfall inside the areas protected by the Freeport levee system was utilized by FEMA from determinations made in the COE study of Freeport and from historical data (Reference 20).

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 2, "Summary of Discharges." No drainage area information is given for the Brazos River and Oyster Creek because, due to the interchange of flows between them, drainage area data are not applicable.

TABLE 2 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
AUSTIN BAYOU					
At river mile 0.0	119.75	4,740	7,613	8,791	11,600
At river mile 5.94	107.85	4,450	7,130	8,230	10,800
At river mile 5.82	103.47	4,320	6,910	7,960	10,400
At river mile 10.23	65.60	3,620	5,960	6,930	9,200
At river mile 15.19	55.28	3,337	5,520	6,434	8,598
At river mile 17.17	52.61	3,273	5,432	6,338	8,479
At river mile 17.90	49.81	3,200	5,325	6,219	8,329
At river mile 17.94	46.85	3,063	5,080	5,926	7,927
At river mile 19.37	45.37	3,068	5,125	5,992	8,036
At river mile 20.61	43.78	3,062	5,149	6,033	8,108
At river mile 20.75	41.15	2,919	4,884	5,714	7,666
At river mile 20.79	38.59	2,788	4,649	5,432	7,278
At river mile 21.99	37.33	2,790	4,684	5,486	7,368
At river mile 22.84	35.29	2,706	4,546	5,325	7,154
At river mile 22.89	33.47	2,606	4,365	5,107	6,853

TABLE 2 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
AUSTIN BAYOU (continued)					
At river mile 24.36	31.76	2,568	4,323	5,067	6,813
At river mile 24.76	28.93	2,416	4,055	4,748	6,378
At river mile 25.27	26.66	2,303	3,863	4,522	6,071
At river mile 25.80	24.64	2,231	3,760	4,407	5,927
At river mile 25.83	20.91	1,985	3,314	3,872	5,191
At river mile 27.78	18.67	1,921	3,245	3,805	5,121
BASTROP BAYOU AND BASTROP BAYOU WEST TRIBUTARY					
At river mile 4.25	195.00	6,646	10,922	12,714	16,600
At river mile 6.78	189.20	6,504	10,671	12,415	16,300
At river mile 6.80	64.60	3,020	4,670	5,323	6,800
At river mile 10.60	60.80	2,880	4,430	5,040	6,550
At river mile 10.65	48.85	2,460	3,740	4,240	5,480
At river mile 13.99	35.22	2,110	3,240	3,690	4,790
At river mile 15.18	24.67	1,740	2,670	3,040	3,950
At river mile 18.63	15.66	1,530	2,350	2,670	3,470
At river mile 20.41	12.71	1,250	1,960	2,240	2,930
At river mile 21.67	10.37	1,050	1,610	1,830	2,370
At river mile 24.80	3.32	470	670	740	930
At river mile 25.04	1.67	290	400	440	550
BASTROP BAYOU EAST TRIBUTARY					
At river mile 21.65	5.69	690	1,020	1,140	1,460
At river mile 25.03	1.92	340	490	550	690
At river mile 26.70	1.05	230	320	350	430
BELL CREEK					
At river mile 0.00	10.23	1,155	1,834	2,106	2,800
At river mile 2.97	8.34	839	1,238	1,387	1,670
At river mile 3.66	7.21	765	1,124	1,258	1,600
At river mile 4.11	6.34	604	837	918	1,150
BRAZOS RIVER					
At river mile 5	*	59,900	60,100	60,700	60,900
At river mile 16	*	75,600	76,600	77,000	78,900
At river mile 21	*	76,200	88,300	95,700	103,000
At river mile 32	*	84,800	93,600	94,600	101,000
At river mile 38	*	90,500	91,800	92,000	92,500
At river mile 50	*	96,100	101,000	101,000	102,000
At river mile 60	*	96,100	105,000	108,000	116,000
At river mile 64	*	97,800	151,000	175,000	234,000

*Data not available

TABLE 2 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
BRUSHY BAYOU					
At river mile 5.02	7.89	846	1,266	1,425	1,828
At river mile 5.87	6.58	738	1,090	1,222	1,558
At river mile 7.29	4.97	626	922	1,032	1,316
At river mile 8.59	3.54	461	653	721	901
At river mile 9.71	2.80	385	534	586	726
At river mile 10.15	1.65	283	391	429	529
CEDAR LAKE CREEK					
At river mile 2.12	48.00	2,500	3,900	4,500	5,900
At river mile 4.38	46.00	2,500	3,800	4,300	5,700
At river mile 6.19	41.00	2,400	3,800	4,400	5,700
At river mile 9.17	36.00	2,300	3,700	4,200	5,500
At river mile 9.89	28.00	2,000	3,100	3,500	4,600
At river mile 11.19	25.01	1,700	2,600	3,000	3,900
CHOCOLATE BAYOU					
At river mile 1.14	156.19	7,650	12,240	14,350	19,030
At river mile 3.14	152.76	7,380	11,700	13,680	18,080
At river mile 5.15	149.33	7,370	11,740	13,750	18,200
At river mile 5.84	141.88	7,150	11,390	13,330	17,650
At river mile 9.04	137.84	7,320	11,830	13,910	18,520
At river mile 9.10	133.27	7,150	11,530	13,550	18,820
At river mile 11.77	130.83	7,320	11,940	14,090	18,820
At river mile 12.43	129.24	7,320	11,970	14,130	18,900
At river mile 14.24	104.09	6,460	10,550	12,450	16,630
At river mile 15.85	101.99	6,460	10,600	12,530	16,770
At river mile 17.55	99.59	6,260	10,210	12,040	16,080
At river mile 17.65	95.48	6,080	9,890	11,650	15,541
At river mile 19.13	93.67	6,050	9,860	11,630	15,520
At river mile 20.74	89.65	5,930	9,690	11,430	15,270
At river mile 22.19	85.35	5,970	9,880	11,700	15,700
At river mile 23.48	83.55	6,020	10,030	11,910	16,020
At river mile 23.91	81.73	5,870	9,720	11,520	15,470
At river mile 24.45	80.29	5,790	9,590	11,360	15,250
At river mile 25.48	76.20	5,560	9,160	10,850	14,540
At river mile 26.01	61.83	4,760	7,750	9,130	12,170
At river mile 27.76	52.31	4,260	6,880	8,080	10,760
At river mile 28.62	22.59	2,440	3,830	4,450	5,850

TABLE 2 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CLEAR CREEK					
At river mile 27.07	54.7	3,320	4,780	5,560	7,290
At river mile 34.46	40.70	2,310	3,720	4,440	6,200
At river mile 38.25	32.12	1,970	3,200	4,030	6,000
At river mile 42.33	21.72	1,450	2,380	3,060	4,500
At river mile 45.90	6.25	630	1,110	1,400	2,150
COCKLEBUR SLOUGH					
At river mile 0.00	18.45	1,209	1,732	1,923	2,300
At river mile 3.66	16.0	1,100	1,500	1,700	2,200
At river mile 4.36	15.0	1,000	1,400	1,500	2,000
At river mile 6.41	14.0	890	1,200	1,300	1,700
At river mile 6.61	2.4	250	310	330	400
At river mile 9.09	1.9	210	250	260	320
At river mile 10.97	1.3	160	180	190	240
At river mile 13.32	1.0	110	120	130	160
COW CREEK					
At river mile 0.47	61.0	3,600	5,900	6,900	9,100
At river mile 1.85	53.0	3,200	5,300	6,200	8,200
At river mile 1.90	48.0	3,000	4,900	5,700	7,500
At river mile 2.97	37.0	2,500	4,100	4,700	6,200
At river mile 4.00	33.0	2,300	3,800	4,400	5,800
At river mile 4.45	27.0	2,100	3,300	3,800	5,100
FLORES BAYOU					
At river mile 0.00	34.58	2,360	3,800	4,380	5,790
At river mile 1.99	33.52	2,334	3,757	4,338	5,737
At river mile 3.36	30.50	2,182	3,494	4,027	5,315
At river mile 4.51	23.39	1,800	2,837	3,253	4,267
At river mile 6.27	21.17	1,725	2,731	3,136	4,120
At river mile 7.31	20.06	1,699	2,705	3,112	4,098
At river mile 8.13	19.31	1,716	2,763	3,190	4,220
At river mile 9.17	14.48	1,478	2,390	2,762	3,659
At river mile 9.90	8.51	1,030	1,629	1,868	2,454
At river mile 10.99	3.60	539	804	903	1,158
At river mile 11.60	2.23	372	535	594	748
At river mile 11.64	1.38	264	370	407	506
HALLS BAYOU					
At river mile 0.00	60.00	3,569	5,959	6,952	9,001
At river mile 7.40	43.21	3,209	5,306	6,183	8,188
At river mile 10.66	38.98	2,620	4,270	4,950	6,570
At river mile 10.80	31.13	2,230	3,590	4,150	5,480
At river mile 12.75	27.95	2,220	3,640	4,230	5,640
At river mile 13.48	26.18	2,210	3,660	4,270	5,710
At river mile 13.55	23.02	2,020	3,320	3,860	5,150
At river mile 15.05	17.94	1,830	3,060	3,570	4,790

TABLE 2 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
HALLS BAYOU (continued)					
At river mile 15.44	12.97	1,480	2,450	2,850	3,810
At river mile 15.50	11.12	1,320	2,170	2,520	3,360
At river mile 16.44	9.86	1,220	1,990	2,310	3,070
At river mile 16.48	6.83	940	1,500	1,730	2,280
At river mile 17.93	5.18	830	1,340	1,540	2,040
At river mile 18.22	2.33	490	770	880	1,160
HAYES CREEK					
At river mile 1.36	11.34	1,132	1,520	1,671	2,048
At river mile 3.43	9.79	1,090	1,487	1,643	2,029
At river mile 3.99	6.53	847	1,146	1,262	1,552
At river mile 5.19	5.16	755	1,027	1,134	1,397
At river mile 6.03	3.24	561	755	829	1,015
At river mile 7.46	1.77	414	564	622	766
LINNVILLE BAYOU					
At river mile 0.00	104.0	3,500	5,400	6,100	8,100
At river mile 12.18	64.0	2,800	4,200	4,700	6,200
At river mile 16.29	47.0	2,500	3,800	4,400	5,800
MARYS CREEK					
At river mile 2.05	17.8	1,300	1,953	2,204	2,836
At river mile 4.81	16.6	1,194	1,806	2,041	2,631
At river mile 7.17	13.8	1,015	1,518	1,709	2,194
At river mile 8.40	8.08	812	1,190	1,331	1,693
At river mile 10.92	3.13	406	562	616	761
MARYS CREEK BY-PASS CHANNEL					
At river mile 0.08	*	680	980	1,100	1,250
MOUND CREEK					
At river mile 0.25	42.0	2,800	4,700	5,500	7,200
At river mile 6.25	30.0	2,300	3,700	4,300	5,700
MUSTANG BAYOU					
At river mile 7.87	45.77	3,744	5,483	6,176	7,918
At river mile 9.87	44.34	3,706	5,427	6,113	7,837
At river mile 11.43	43.19	3,645	5,320	5,986	7,664
At river mile 13.42	41.36	3,574	5,202	5,850	7,483
At river mile 15.55	33.46	3,232	4,633	5,186	6,593
At river mile 16.70	32.77	3,200	4,580	5,125	6,511
At river mile 18.34	31.64	3,105	4,408	4,919	6,227
At river mile 20.87	28.83	2,969	4,221	4,720	6,021
At river mile 21.90	27.32	2,305	3,280	3,656	4,633

*Data not available

TABLE 2 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
MUSTANG BAYOU (continued)					
At river mile 23.01	26.65	1,984	2,843	3,171	4,019
At river mile 23.71	25.74	1,521	2,213	2,470	3,133
At river mile 24.41	23.32	1,390	1,998	2,221	2,800
At river mile 25.99	22.71	1,391	2,010	2,238	2,830
At river mile 29.23	20.56	1,293	1,857	2,063	2,601
At river mile 31.53	17.32	1,043	1,436	1,573	1,942
At river mile 32.31	16.20	989	1,354	1,480	1,822
At river mile 34.08	14.06	876	1,180	1,284	1,569
At river mile 35.52	13.05	855	1,160	1,264	1,550
At river mile 37.79	11.50	814	1,113	1,217	1,497
At river mile 40.41	10.30	779	1,072	1,174	1,448
OYSTER CREEK					
At river mile 4	*	4,100	4,400	4,400	4,400
At river mile 17	*	5,600	5,800	5,800	5,900
At river mile 25	*	6,800	6,800	6,800	6,800
At river mile 36	*	1,500	14,000	17,900	22,000
At river mile 49	*	3,620	16,200	23,400	38,900
At river mile 58	*	3,000	15,400	22,700	38,100
At river mile 68	*	2,210	13,900	22,000	42,100
At river mile 82	*	160	1,040	1,500	4,090
SAN BERNARD RIVER					
At river mile 0.7	995	18,400	28,800	33,500	45,000
At river mile 9.5	965	17,800	27,900	32,400	42,500
At river mile 46.0	874	18,600	30,100	35,400	46,600
At river mile 62.5	755	17,400	28,400	33,600	44,200
STEVENSON SLOUGH					
At river mile 1.05	2.3	400	590	670	860
At river mile 1.17	1.6	380	540	610	770
At river mile 2.28	1.1	170	240	270	340
At river mile 3.50	0.9	100	120	130	140
UNNAMED TRIBUTARY TO CHOCOLATE BAYOU					
At river mile 0.00	7.38	855	1,132	1,238	1,506
At river mile 1.09	6.51	773	1,013	1,104	1,334
At river mile 1.12	5.69	702	913	993	1,195
At river mile 2.00	5.29	668	866	940	1,129
At river mile 3.60	3.88	583	766	835	1,009
At river mile 4.99	2.61	493	661	725	886
At river mile 6.21	1.07	282	370	403	486

*Data not available

TABLE 2 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
VARNER CREEK					
At river mile 0.32	63.0	3,500	5,800	6,800	9,000
At river mile 1.22	60.0	3,400	5,600	6,600	8,700
At river mile 2.18	52.0	3,400	5,800	6,800	9,000
At river mile 4.40	25.0	2,000	3,300	3,800	5,100
At river mile 4.79	22.0	1,900	3,100	3,600	4,800
At river mile 6.62	16.0	1,600	2,600	3,100	4,000
At river mile 7.91	10.0	1,200	1,900	2,100	2,800
At river mile 8.98	5.7	860	1,400	1,600	2,100
WEST FORK CHOCOLATE BAYOU					
At river mile 0.00	27.87	2,274	3,273	3,685	4,671
At river mile 2.42	23.62	2,057	2,954	3,322	4,205
At river mile 4.43	15.31	1,573	2,238	2,509	3,162
At river mile 6.43	12.56	1,427	2,041	2,292	2,895
At river mile 6.46	10.53	1,259	1,783	1,995	2,507
At river mile 7.42	9.46	1,224	1,753	1,969	2,489
At river mile 8.28	6.57	899	1,241	1,377	1,710
At river mile 8.33	4.27	661	891	980	1,203

The determination of coastal inundation caused by the passage of hurricanes was approached using the joint probability method (Reference 21). The storm population was described by probability distributions of five parameters that influence stillwater elevations. These five parameters were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These parameters, or storm characteristics, were described statistically based on an analysis of observed storms. Primary sources of data were provided by COE storm reports, the National Weather Service, the National Hurricane Research Project, and the Monthly Weather Review (References 4, 5, 6, 22, 23, 24, 25, and 26). Parameter values for surge elevations are shown in Table 3.

TABLE 3 - PARAMETER VALUES FOR SURGE ELEVATIONS

Central Pressure Depression (mb)	82	65	48	31	14
Probability:	0.09	0.25	0.20	0.22	0.24
Storm Radius (nm)	10	15	20	25	
Probability:	0.13	0.31	0.30	0.26	

TABLE 3 - PARAMETER VALUES FOR SURGE ELEVATIONS (continued)

Forward Speed (kt)	5	9	13		
Probability:	0.30	0.35	0.35		
Crossing Angle	-140	-115	-90	-65	-40
Probability:	0.11	0.39	0.17	0.23	0.1
Angular Rate	0.0001914	0.0006786	0.0002958	0.0004002	0.000174

Frequency of Occurrence for Area Studied: 1.74×10^{-3} storms/nm/year

To establish the 10-, 50-, 100-, and 500-year stillwater elevations, the standard FEMA coastal surge model was used to simulate the coastal surge generated by any chosen storm (any combination of the five storm parameters previously defined). Performing such simulations for a large number of storms, each of a known probability, permitted the establishment of the frequency distribution of surge heights as a function of coastal location. The astronomic tide for the region was statistically combined with the computed storm surge to yield recurrence intervals of total stillwater elevations. This procedure is outlined in the Coastal Flooding Handbook (Reference 27).

The storm surge model takes into account a grid pattern approximating the geographical features of the study area and the adjoining area. Surges were computed using a grid of 5 nautical miles. Bathymetric data and land heights for the model grid systems were obtained from National Oceanic and Atmospheric Administration nautical charts and USGS topographic maps (References 28, 29, 30, 31, 32, 33, 34, 35, 36, and 37).

A one-dimensional inland flow model was used to determine elevations and flows along rivers and canals from coastal surge. This model is embedded within the two-dimensional grid scheme; it assumes that fluid motion within these rivers is predominantly in the longitudinal direction and that wind effects on the river are small compared with the surge (Reference 27).

The stillwater elevations for the 10-, 50-, 100-, and 500-year floods have been determined for West Bay and the Gulf of Mexico and are summarized in Table 4. Because of variations in the elevations, they are listed by transects, which are described in Section 3.2 and located on Figure 2. The analyses reported in this study reflect the stillwater elevations, shown in Table 4, due to tidal and wind setup effects and include the contributions from wave action effects (discussed in Section 3.2).

TABLE 4 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WEST BAY				
Transect 1	4.9	7.6-11.5	9.5-12.8	13.0-15.4
Transect 2	4.9-6.0	10.4-13.3	11.9-15.3	14.4-19.6
Transect 3	5.8-7.3	11.0-13.5	12.3-16.3	15.3-19.9
Transect 4	4.6-6.8	10.7-12.6	12.3-16.3	15.3-19.4
GULF OF MEXICO				
Transect 5	1.2-5.8	8.7-10.7	10.5-13.4	13.3-17.8
Transect 6	1.0-5.8	7.3-10.7	9.6-11.9	12.5-15.5
Transect 7	1.8-5.8	6.8-10.7	9.2-11.9	12.5-14.2
Transect 8	1.0-5.8	4.8-10.7	7.2-11.9	11.7-14.2
Transect 9	3.5-4.9	5.9-8.6	6.9-9.9	9.7-12.1
Transect 10	4.9	6.5-8.9	8.7-10.1	11.5-13.5
Transect 11	4.9	8.5-9.8	9.9-11.4	12.0-13.5
Transect 12	4.9	8.4-9.3	9.8-10.4	12.0-13.0
Transect 13	5.0	7.4-8.9	9.7-10.2	12.1-13.1
Transect 14	5.0	8.9-9.7	10.0-10.9	12.1-13.0
Transect 15	5.0	8.9-9.8	10.0-10.9	12.1-13.1
Transect 16	5.0-5.5	8.9-9.9	10.0-11.0	12.1-13.1
Transect 17	1.9-5.5	8.9-9.8	10.0-11.0	12.1-13.1
Transect 18	5.0-5.5	8.9-9.8	10.0-11.0	12.1-13.1
Transect 19	1.6-5.4	4.3-8.8	5.6-9.8	7.9-11.9
Transect 20	1.4-5.9	4.9-8.8	6.8-9.8	9.2-12.2
Transect 21	4.8	5.6-8.6	6.8-9.6	10.4-12.0
Transect 22	2.9-4.8	6.9-8.6	8.1-9.6	10.6-11.9
Transect 23	3.9-4.8	7.6-10.5	8.7-11.6	10.8-13.8

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses of the streams studied by detailed methods were obtained by field surveys. This surveying effort included data on the overbank areas and all bridge and culvert crossings. For the restudy of the San Bernard River performed by the COE, some surveyed cross sections were extended using topographic data from appropriate USGS topographic maps (Reference 37).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Roughness coefficients (Manning's "n") used in the hydraulic computations were assigned on the basis of engineering judgment and field inspection of the stream and floodplain areas. The following tabulation shows the channel and overbank "n" values for the streams studied by detailed methods.

Stream	Channel "n"	Overbank "n"
Austin Bayou	0.051-0.065	0.040-0.060
Bastrop Bayou and Bastrop Bayou West Tributary	0.012-0.085	0.035-0.095
Bastrop Bayou East Tributary	0.012-0.070	0.035-0.095
Bell Creek	0.015-0.045	0.030-0.070
Brazos River	0.030-0.040	0.033-0.119
Brushy Bayou	0.012-0.115	0.035-0.120
Cedar Lake Creek	0.035-0.055	0.044-0.100
Chocolate Bayou	0.035-0.085	0.035-0.085
Clear Creek	0.025-0.100	0.010-0.150
Cocklebur Slough	0.012-0.055	0.043-0.071
Cow Creek	0.045-0.055	0.057-0.100
Flores Bayou	0.055-0.075	0.040-0.060
Halls Bayou	0.030-0.046	0.040-0.100
Hayes Creek	0.050-0.075	0.035-0.040
Linnville Bayou	0.040-0.061	0.035-0.092
Marys Creek	0.012-0.100	0.040-0.065
Marys Creek By-Pass Channel	0.025-0.095	0.050-0.055
Mound Creek	0.055-0.091	0.055-0.088
Mustang Bayou	0.030-0.045	0.040-0.125
Oyster Creek	0.025-0.070	0.030-0.100
San Bernard River	0.030-0.050	0.050-0.150
Stevenson Slough	0.016-0.055	0.021-0.071
Unnamed Chocolate Tributary	0.012-0.060	0.035-0.080
Varner Creek	0.036-0.046	0.018-0.096
West Fork Chocolate Bayou	0.060	0.090

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 16); for the San Bernard River, the COE 723-X6-L202A HEC-2 computer program was used to determine the water-surface elevations (Reference 38). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Starting water-surface elevations for East Branch Bastrop Bayou, Linnville Bayou, and West Fork Chocolate Bayou were calculated using coincident peaks. A known starting water-surface elevation equal to the mean tidal elevation was used for the analysis of Clear Creek. Starting water-surface elevations for all other streams studied by detailed methods were calculated using the slope/area method.

Certain structures on various streams in the county were not modeled in their respective hydraulic models, because they were determined to be hydraulically insignificant.

The area of 500-year flooding to the west of the Brazos River at the confluence of Cow Creek reflects overflow of the 100-year flood from the Brazos River. These overflows collect in Cow Creek and make their way back into the Brazos River. Cow Creek is shown as

approximate flooding at this location because these overflows make the calculation of a flood elevation on Cow Creek difficult.

Hydraulic analyses for Clear Creek were adopted from the Flood Insurance Studies for the unincorporated areas of Harris County and the City of Houston, Texas (References 39 and 40). Water-surface elevations were computed using the HEC-2 program. These elevations were adjusted to account for land subsidence between 1973 and 1979 for the portion of Clear Creek within the unincorporated areas of Brazoria County; however, since these elevations were not adjusted for the portion of Clear Creek within the City of Brookside Village and the City of Pearland, elevation differences exist between the City of Brookside Village and the City of Pearland, and the unincorporated areas of Brazoria County.

Several areas of the county experience shallow flooding. Oyster Creek overtops its high east banks midway through the county. The resulting shallow flooding is obstructed by the Angleton Levee which runs north to south, parallel to the creek. The levee forms the eastern limits of the shallow flooding area.

The area between Stevenson Slough and the San Bernard River east of Sweeny, Texas, experiences shallow flooding. This is a result of the waters of Stevenson Slough breaking over a high ridge along the east bank of the stream into an area which gradually slopes toward the San Bernard River. The eastern edge of the shallow flooding area meshes with the flooding of the San Bernard River. Shallow flooding is obstructed by the Missouri-Pacific Railroad to the south.

Hydraulic analyses were performed on Buffalo Camp Bayou, and it was determined that the flooding created by it is completely controlled by the flooding from the Brazos River and Oyster Creek. As a result, no profile is shown.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding source studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along the shoreline.

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The COE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (Reference 41). The 3-foot wave has been determined as the minimum size wave capable of causing major damage to conventional wood frame or brick veneer structures.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in the National Academy of Sciences report (Reference 28). This method is based on three major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth, and the wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that the wave height may be diminished by dissipation of energy due to the presence of obstructions such as sand dunes, dikes, seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures described in Reference 28. The third major concept is that the wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

These concepts and equations were used to compute wave heights and wave crest elevations associated with the 100-year storm surge. Accurate topographic, land-use, and land-cover data are required for the wave height analysis. Maps of the shoreline areas at a scale of 1:250,000 with a bathymetric interval of 2 meters and maps at a scale of 1:24,000 with a contour interval of 5 feet were used for the topographic data (References 36 and 37). The land-use and land-cover data were obtained from aerial photographs (Reference 42).

Wave heights were computed along transects (cross section lines) that were located along the coastal areas. The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects. Figure 2, "Transect Location Map," illustrates the location of the transects for Brazoria County.

Along each transect, wave heights and wave crest elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The 100-year stillwater elevations were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave crest elevations were determined at whole-foot increments along the transect. The location of the 3-foot breaking wave for determining the terminus of the V zone (area with velocity wave action) was also computed at each transect. It was assumed that the beach area would erode during a major storm, thus reducing its effectiveness in decreasing wave heights.

FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX
AND INCORPORATED AREAS

APPROXIMATE SCALE

4.5 0 4.5 9 13.5 MILES

TRANSECT LOCATION MAP

Figure 3 is a profile for a typical transect illustrating the effects of energy dissipation and regeneration on a wave as it moves inland. This figure shows the wave crest elevations being decreased by obstructions, such as buildings, vegetation, and rising ground elevations, and being increased by open, unobstructed wind fetches. Actual wave conditions in the county may not include all the situations illustrated in Figure 3.

After analyzing wave heights along each transect, wave crest elevations were interpolated between transects. Various source data were used in the interpolation, including the topographic work maps, notes and photographs taken during field inspection, and engineering judgment. Controlling features affecting the wave crest elevations were identified and considered in relation to their positions at a particular transect and their variation between transects. The results of the calculations are accurate until local topography, vegetation, or cultural development within the community undergo any major changes. The results of this analysis are summarized in Table 5.

TABLE 5 - TRANSECT DATA

Flooding Source	Stillwater Elevation 10-Year	Stillwater Elevation 100-Year	Zone	Base Flood Elevation (Feet NGVD)*
West Bay				
Transect 1	4.9	9.5-12.8	VE	15-17
			AE	10-15
Transect 2	4.9-6.0	11.9-15.3	VE	15-17
			AE	15
Transect 3	5.8-7.3	12.3-16.3	VE	15-18
			AE	15-16
Transect 4	4.6-6.8	12.3-16.3	VE	15-18
			AE	14-16
Gulf of Mexico				
Transect 5	1.2-5.8	10.5-13.4	VE	15-18
			VE	15-18
			AE	13-15
Transect 6	1.0-5.8	9.6-11.9	VE	14-17
			VE	12-13
			AE	12
Transect 7	1.8-5.8	9.2-11.9	VE	14-17
			VE	12-13
			AE	11-12
Transect 8	1.0-5.8	7.2-11.9	VE	14-16
			VE	12-13
			AE	7-12

*Due to map scale limitations, base flood elevations shown on the FIRM may represent average elevations for the zones depicted.

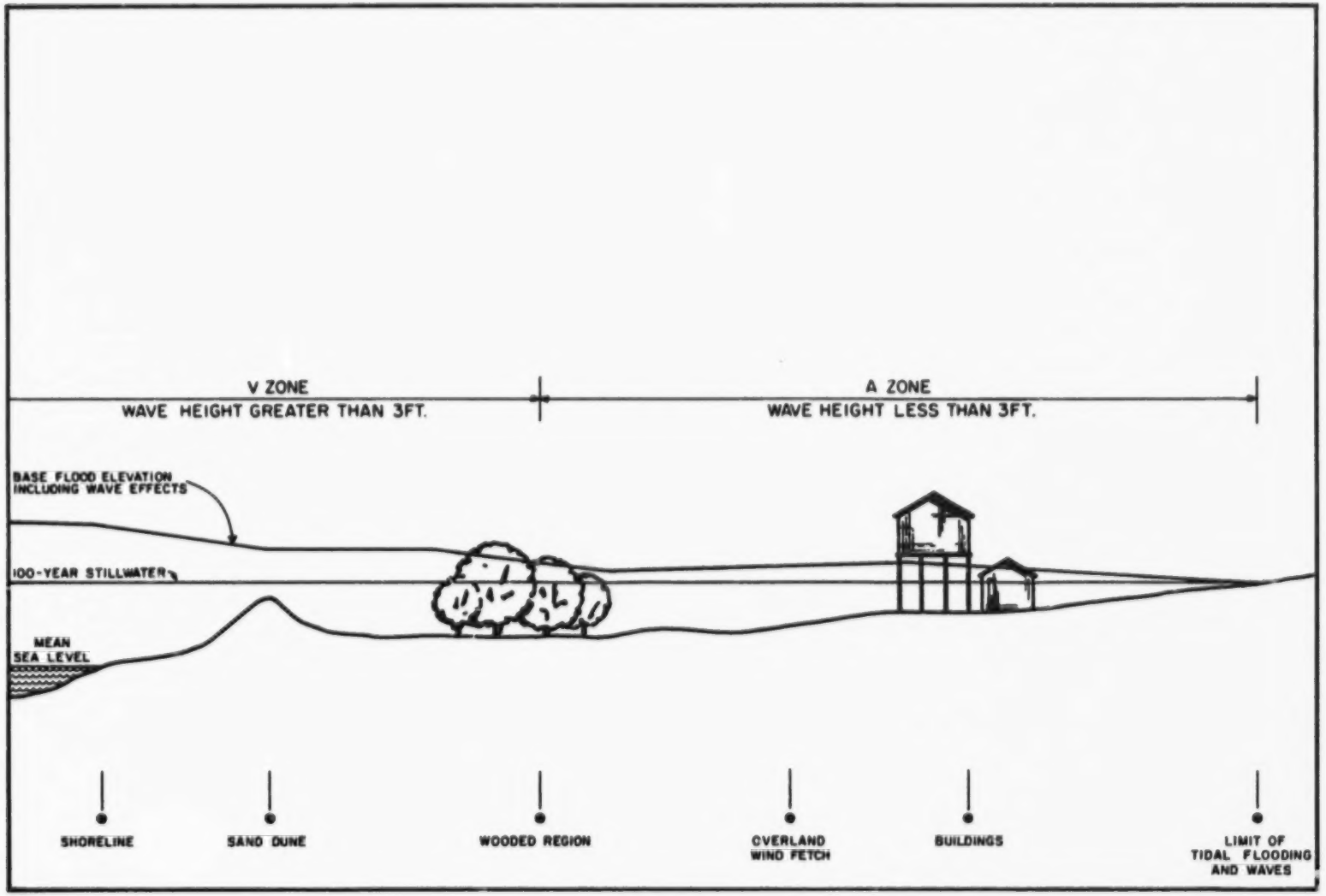


FIGURE 3
TYPICAL TRANSECT SCHEMATIC

TABLE 5 - TRANSECT DATA - continued

Flooding Source	Stillwater Elevation 10-Year	Stillwater Elevation 100-Year	Zone	Base Flood Elevation (Feet NGVD)*
Gulf of Mexico (continued)				
Transect 9	3.5-4.9	6.9-9.9	VE	12-15
			AE	7-9
			AE	10-11
Transect 10	4.9	8.7-10.1	VE	12-15
			AE	10-11
Transect 11	4.9	9.9-11.4	VE	12-15
			AE	11
Transect 12	4.9	9.8-10.4	VE	12-15
			AE	10-11
Transect 13	5.0	9.7-10.2	VE	12-15
			AE	10-11
Transects 14-15	5.0	10.0-10.9	VE	12-15
Transect 16	5.0-5.5	10.0-11.0	VE	12-15
Transect 17	1.9-5.5	10.0-11.0	VE	12-15
Transect 18	5.0-5.5	10.0-11.0	VE	12-15
Transect 19	1.6-5.4	5.6-9.8	VE	12-15
			AE	7-8
			AE	9-11
Transect 20	1.4-5.9	6.8-9.8	VE	12-15
			AE	7-8
			AE	9-11
Transect 21	4.8	6.8-9.6	VE	11-15
			AE	7-8
			AE	9-11
Transect 22	2.9-4.8	8.1-9.6	VE	11-15
			AE	10-11
Transect 23	3.9-4.8	8.7-11.6	VE	11-15
			AE	9-11

*Due to map scale limitations, base flood elevations shown on the FIRM may represent average elevations for the zones depicted.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3). The elevation of these reference marks were established by the study contractor reflecting either the 1973 or 1979 releveling performed by the National Geodetic Survey.

3.3 Land Subsidence

The prevalence of land subsidence in the study area complicates the determination of the expected depth of flooding at a property. This information should always be obtained by direct comparison of the

current property elevation with the official base flood elevation at that property as shown on the Flood Insurance Rate Map and accompanying Flood Profiles (Sections 5.4 and 3.2, respectively).

Care should be exercised in using elevation reference marks to determine property elevations, since their listed elevations may not reflect current property elevations if subsidence has occurred since they were established.

Local officials should be aware of the subsidence problem and should require the use of the most up-to-date and accurate property elevation data in compensating for land subsidence; however, base flood elevations should not be adjusted but obtained directly from the Flood Insurance Rate Map and accompanying profiles.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 5 feet and at a scale of 1:4,800 with a contour interval of 1 foot (References 37 and 43).

For the flooding associated with Brisco Canal and Ditch C-1 in the City of Alvin, a 1975 study prepared by Landev Engineers, Inc., was used as a guide in delineating floodplain boundaries in conjunction with information collected after the 1979 flood brought on by Tropical Storm Claudette (Reference 44).

For tidal areas without wave action, the 100-year and 500-year boundaries were delineated using topographic maps at a scale of 1:24,000 with a contour interval of 5 feet (Reference 37). For the tidal areas with wave action, the floodplain boundaries were delineated using the elevations determined at each transect; between transects, the boundaries were interpolated using engineering judgment, land-cover data, and the topographic maps referenced

above. The 100-year floodplain was divided into whole-foot elevation zones based on the average wave envelope elevation in that zone. Where the map scale did not permit these zones to be delineated at one foot intervals, larger increments were used.

For the streams studied by approximate methods, the boundary of the 100-year flood was delineated using the floodplain boundaries from the previously effective studies for the unincorporated areas of Brazoria County and the Cities of Alvin, Angleton, Freeport, and Liverpool (References 45, 46, 47, 48, and 49).

Shallow flooding zones have been delineated adjacent to Bastrop Bayou, the Brazos River, Marys Creek, and Oyster Creek. The extent of shallow flooding was determined using physical features, topographic maps, engineering judgment, and depths obtained from the FLOW SIM 10 model for the Brazos River/Oyster Creek watershed (References 37 and 13).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AO, and VE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

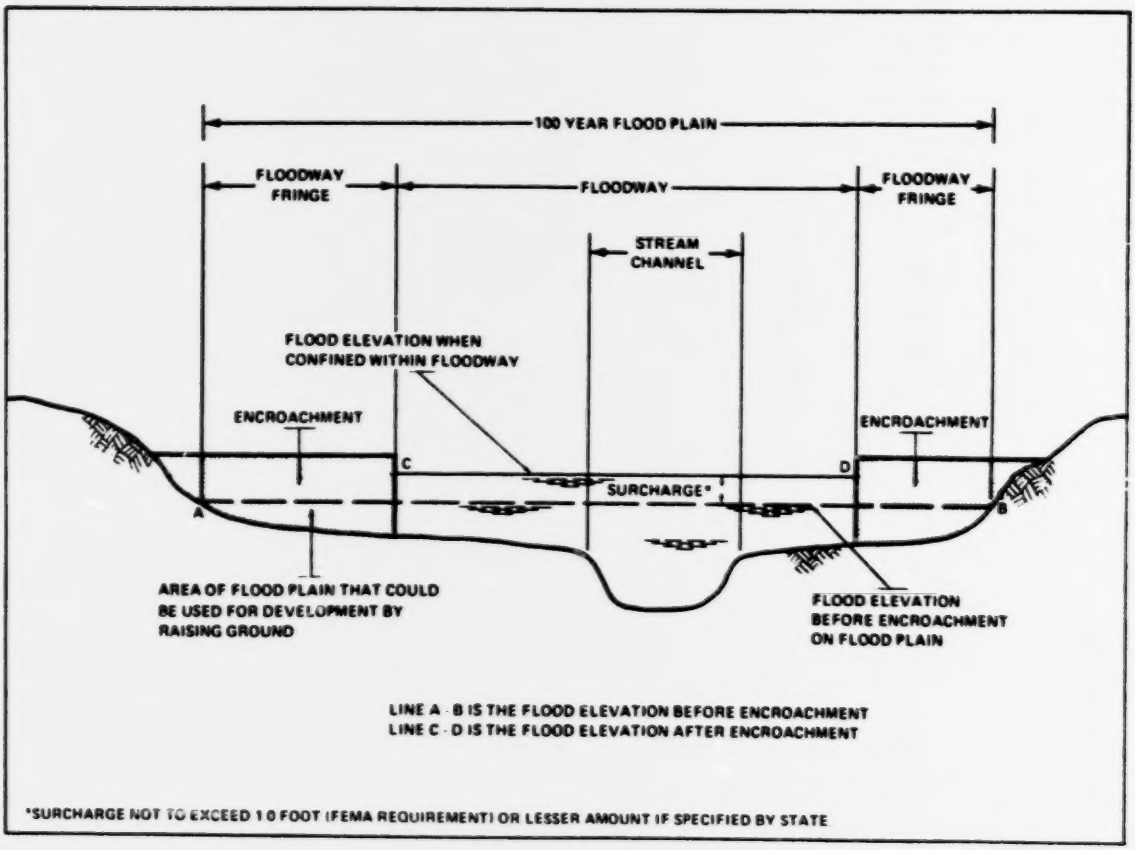
For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 6). The computed floodways are shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodway widths for Cedar Lake Creek, Clear Creek, Cow Creek, Halls Bayou, and Linnville Bayou extend beyond the county boundary.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC

Figure 4

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Austin Bayou								
A	1,400	1,954	7,233	1.2	*	4.5	5.5	1.0
B	6,600	3,445	16,291	0.5	*	4.9	5.9	1.0
C	12,000	2,978	10,667	0.8	*	5.2	6.2	1.0
D	17,800	1,403	6,632	1.3	*	6.1	7.0	0.9
E	26,400	1,647	7,390	1.2	*	7.4	8.4	1.0
F	31,900	1,533	8,796	0.9	*	8.3	9.2	0.9
G	35,900	2,237	9,497	0.8	8.6	8.6	9.5	0.9
H	41,900	1,195	8,810	0.9	8.9	8.9	9.9	1.0
I	47,800	1,833	9,326	0.9	9.2	9.2	10.2	1.0
J	53,100	692	4,827	1.6	9.8	9.8	10.8	1.0
K	57,200	789	5,057	1.4	10.6	10.6	11.6	1.0
L	61,500	1,527	7,477	0.9	11.2	11.2	12.2	1.0
M	63,000	655	3,566	1.9	11.5	11.5	12.5	1.0
N	64,600	1,054	4,640	1.5	12.1	12.1	13.1	1.0
O	67,100	1,994	10,650	0.7	12.5	12.5	13.5	1.0
P	72,300	2,102	8,745	0.7	12.8	12.8	13.8	1.0
Q	75,900	600	4,112	1.6	13.3	13.3	14.2	0.9
R	77,200	269	2,329	2.8	14.0	14.0	14.7	0.7
S	81,200	843	5,015	1.3	15.1	15.1	15.9	0.8
T	87,000	376	3,185	2.0	16.5	16.5	17.4	0.9
U	90,900	638	3,308	1.9	17.6	17.6	18.6	1.0
V	95,800	212	1,955	3.0	19.3	19.3	20.3	1.0
W	100,600	276	1,737	3.4	20.9	20.9	21.9	1.0

[1]Feet above confluence with Bastrop Bayou
*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

AUSTIN BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Austin Bayou (continued)								
X	100,700[1]	1,450	6,395	0.9	21.2	21.2	22.1	0.9
Y	104,400[1]	901	4,060	1.5	21.8	21.8	22.7	0.9
Z	107,300[1]	1,300	6,980	0.9	22.2	22.2	23.1	0.9
AA	109,500[1]	1,350	8,829	0.6	22.3	22.3	23.2	0.9
AB	111,900[1]	850	1,715	3.2	23.1	23.1	23.9	0.8
AC	113,600[1]	550	2,338	2.3	24.5	24.5	25.5	1.0
AD	119,500[1]	700	5,066	1.1	27.1	27.1	27.8	0.7
AE	119,800[1]	556	3,213	1.6	27.3	27.3	28.1	0.8
AF	122,300[1]	1,150	4,336	1.2	27.9	27.9	28.8	0.9
AG	125,800[1]	818	3,095	1.6	28.9	28.9	29.9	1.0
AH	130,200[1]	953	4,865	0.9	29.8	29.8	30.7	0.9
AI	133,000[1]	973	3,860	1.2	30.1	30.1	31.0	0.9
AJ	136,100[1]	810	2,221	2.0	31.3	31.3	32.2	0.9
AK	137,100[1]	893	3,826	1.0	31.5	31.5	32.5	1.0
AL	139,700[1]	916	3,013	1.3	32.2	32.2	33.2	1.0
AM	142,600[1]	531	1,847	2.1	33.3	33.3	34.3	1.0
AN	145,400[1]	865	2,831	1.3	34.9	34.9	35.9	1.0
Bastrop Bayou								
A	23,415[2]	542	2,695	1.7	*	4.6	5.6	1.0
B	26,465[2]	201	2,147	2.1	*	5.0	6.0	1.0
C	29,115[2]	177	1,934	3.8	*	5.5	6.4	0.9
D	32,900[2]	1,136	6,953	1.8	*	6.2	7.1	0.9
E	36,800[2]	4,998	25,621	0.5	*	6.3	7.3	1.0
F	40,600[2]	1,856	10,118	0.0	*	6.3	7.3	1.0

[1]Feet above confluence with Bastrop Bayou
[2]Feet above confluence with Intracoastal Waterway
*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

AUSTIN BAYOU - BASTROP BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	[1] DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Bastrop Bayou (continued)								
G	44,100	4,291	19,140	0.0	*	6.3	7.3	1.0
H	47,400	5,125	19,621	0.2	*	6.3	7.3	1.0
I	52,100	342	3,276	0.0	*	6.3	7.3	1.0
J	57,700	305	3,257	1.3	*	6.4	7.3	0.9
K	62,200	462	3,039	1.4	*	6.9	7.7	0.8
L	66,500	298	2,956	1.2	7.4	7.4	8.1	0.7
M	70,500	256	2,486	1.5	7.7	7.7	8.4	0.7
N	73,700	400	3,408	1.1	8.2	8.2	8.8	0.6
O	79,200	189	2,029	1.5	8.9	8.9	9.4	0.5
P	84,000	167	1,529	1.7	9.8	9.8	10.2	0.4
Q	89,200	206	1,878	1.4	10.9	10.9	11.2	0.3
R	92,200	103	1,282	2.1	11.4	11.4	11.7	0.3
S	98,200	140	1,519	1.8	12.8	12.8	13.1	0.3
T	105,400	128	1,235	1.8	14.8	14.8	15.1	0.3
U	113,500	200	1,327	1.4	17.5	17.5	18.3	0.8
Bastrop Bayou West Tributary								
V	119,600	67	592	1.2	18.7	18.7	19.7	1.0
W	123,300	63	455	1.6	19.3	19.3	20.2	0.9
X	124,400	41	283	2.6	19.7	19.7	20.6	0.9
Y	126,800	297	1,249	0.6	20.0	20.0	20.9	0.9
Z	131,300	131	436	1.0	20.2	20.2	21.1	0.9

[1] Feet above confluence with Intracoastal Waterway

*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

BASTROP BAYOU - BASTROP BAYOU WEST TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Bastrop Bayou East Tributary								
A	118,600[1]	200	553	2.1	18.6	18.6	19.3	0.7
B	120,100[1]	180	719	1.6	19.0	19.0	19.7	0.7
C	121,000[1]	152[3]	767	1.5	19.3	19.3	19.9	0.6
D	127,600[1]	63[3]	371	1.5	22.1	22.1	22.3	0.2
E	130,800[1]	62	333	1.7	23.3	23.3	23.6	0.3
F	132,200[1]	71	336	1.6	23.6	23.6	24.0	0.4
G	135,100[1]	281	719	0.5	23.7	23.7	24.3	0.6
H	138,900[1]	68	335	1.0	24.0	24.0	24.6	0.6
I	142,100[1]	50	253	1.2	24.1	24.1	24.7	0.6
Bell Creek								
A	2,600[2]	95	615	3.4	24.7	10.8[4]	10.9	0.1
B	4,800[2]	90	558	3.8	24.7	13.4[4]	13.4	0.0
C	6,700[2]	166	1,118	1.9	24.7	14.5[4]	14.5	0.0
D	8,600[2]	51	275	7.7	24.7	15.3[4]	15.3	0.0
E	9,800[2]	106	632	3.3	24.7	18.5[4]	18.5	0.0
F	10,900[2]	128	494	4.3	24.7	20.1[4]	20.1	0.0
G	13,730[2]	172	789	2.7	24.7	24.0[4]	24.1	0.1
H	16,230[2]	137	857	1.6	24.7	24.5[4]	24.8	0.3
I	17,720[2]	274	1,281	1.1	24.7	24.6[4]	24.9	0.3
J	20,090[2]	192	501	2.5	25.1	25.1	25.7	0.6
K	22,190[2]	200	836	1.1	30.3	30.3	31.0	0.7
L	24,480[2]	38	170	5.4	30.6	30.6	31.2	0.6
M	25,700[2]	346	973	0.9	32.3	32.3	33.3	1.0
N	28,000[2]	127	436	2.1	33.2	33.2	34.1	0.9

[1]Feet above confluence with Intracoastal Waterway
[2]Feet above confluence with San Bernard River
[3]Floodway defined at upper channel banks
[4]Elevation computed without consideration of backwater effects from San Bernard River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

BASTROP BAYOU EAST TRIBUTARY - BELL CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Brazos River								
A	4.8[1]	633	10,842	5.5	7.9	7.9	8.0	0.1
B	5.7[1]	615	11,588	5.2	9.2	9.2	9.3	0.1
C	6.5[1]	566	12,773	4.7	10.0	10.0	10.1	0.1
D	7.5[1]	572	12,348	4.9	10.9	10.9	11.0	0.1
E	8.6[1]	417	10,336	5.9	12.3	12.3	12.4	0.1
F	9.5[1]	412	10,490	6.2	13.5	13.5	13.7	0.2
G	10.2[1]	452	13,552	4.8	14.4	14.4	14.6	0.2
H	10.8[1]	495	19,307	3.4	14.8	14.8	15.0	0.2
I	11.7[1]	410	14,448	4.5	15.0	15.0	15.3	0.3
J	12.5[1]	748	14,749	5.6	15.8	15.8	16.1	0.3
K	13.1[1]	725	18,276	5.2	16.6	16.6	16.9	0.3
L	13.8[1]	513	16,477	5.5	17.7	17.7	17.9	0.2
Brushy Bayou								
A	0.76[2]	557	1,302	0.5	*	6.7[4]	7.7	1.0
B	1.32[2]	162	425	1.4	8.7	7.2[4]	8.2	1.0
C	1.97[2]	60	223	2.3	9.1	9.0[4]	9.9	0.9
D	2.86[2]	520	1,005	0.4	11.6	11.6	12.6	1.0
E	3.69[2]	24	49	3.3	11.9	11.9	12.9	1.0
F	4.17[3]	18	94	0.5	13.2	13.2	13.9	0.7
G	26,500[3]	193	539	2.6	18.1	18.1	19.0	0.9
H	30,900[3]	116	526	2.3	21.0	21.0	21.3	0.3
I	31,900[3]	94	549	2.2	22.6	22.6	23.0	0.4
J	35,800[3]	66	456	2.3	25.3	25.3	25.9	0.6
K	38,500[3]	113	711	1.5	28.5	28.5	29.0	0.5
L	42,000[3]	56	437	1.7	29.3	29.3	29.9	0.6

[1]Miles above confluence with Intracoastal Waterway
[2]Miles above confluence with Austin Bayou
[3]Feet above confluence with Austin Bayou
[4]Elevation computed without consideration of backwater effects from Austin Bayou
*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

BRAZOS RIVER - BRUSHY BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Brushy Bayou (continued)								
M	45,300[1]	273	672	1.1	30.4	30.4	31.1	0.7
N	47,000[1]	136	303	1.9	31.2	31.2	32.0	0.8
O	48,100[1]	505	1,842	0.3	31.4	31.4	32.2	0.8
P	49,300[1]	173	335	1.7	31.8	31.8	32.6	0.8
Q	51,300[1]	392	1,495	0.3	32.0	32.0	32.9	0.9
R	52,300[1]	368	1,350	0.3	32.0	32.0	32.9	0.9
S	53,600[1]	139	285	1.5	32.1	32.1	32.9	0.8
Cedar Lake Creek								
A	29,050[2]	184/50[3]	1,441	3.2	*	8.1	9.1	1.0
B	31,690[2]	2615/100[3]	12,916	0.4	*	8.4	9.4	1.0
C	34,594[2]	2493/479[3]	9,639	0.5	*	8.5	9.5	1.0
D	38,765[2]	3217/2000[3]	13,238	0.4	*	8.6	9.6	1.0
E	41,299[2]	253/190[3]	2,355	2.0	8.8	8.8	9.8	1.0
F	43,200[2]	196/140[3]	2,059	2.2	8.8	8.8	9.8	1.0
G	44,750[2]	273/170[3]	2,542	1.8	9.0	9.0	9.9	0.9
H	45,950[2]	265/145[3]	2,437	1.8	9.2	9.2	10.1	0.9
I	47,550[2]	241/135[3]	2,242	2.0	9.4	9.4	10.3	0.9
J	49,150[2]	236/140[3]	2,346	1.9	9.6	9.6	10.4	0.8
K	50,950[2]	244/155[3]	2,331	1.9	9.9	9.9	10.7	0.8
L	52,580[2]	208/140[3]	1,632	2.8	10.1	10.1	10.8	0.7
M	55,100[2]	243/175[3]	2,265	1.9	10.6	10.6	11.2	0.6
N	57,400[2]	221/180[3]	2,339	1.8	11.0	11.0	11.5	0.5
O	59,800[2]	246/180[3]	2,394	1.8	11.3	11.3	11.8	0.5
P	62,600[2]	202/100[3]	2,436	1.8	11.6	11.6	12.1	0.5

[1]Feet above confluence with Austin Bayou
[2]Feet above confluence with Intracoastal Waterway
[3]Width/width within county boundary
*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

BRUSHY BAYOU - CEDAR LAKE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Cedar Lake Creek (continued)								
Q	64,700[1]	178/100[3]	2,185	2.0	11.9	11.9	12.2	0.3
R	66,500[1]	187/95[3]	2,123	2.1	12.1	12.1	12.4	0.3
S	69,500[1]	155/130[3]	1,753	2.5	12.4	12.4	12.8	0.4
T	71,500[1]	161/100[3]	1,975	2.2	12.8	12.8	13.1	0.3
U	74,400[1]	123/110[3]	1,682	2.6	13.4	13.4	13.7	0.3
V	77,700[1]	349/100[3]	1,935	2.3	14.2	14.2	14.6	0.4
W	80,400[1]	319/160[3]	1,779	2.4	14.9	14.9	15.4	0.5
X	82,400[1]	226/150[3]	1,340	3.1	15.8	15.8	16.5	0.7
Y	84,200[1]	421/280[3]	2,231	1.6	16.5	16.5	17.3	0.8
Z	86,000[1]	325/110[3]	1,094	3.2	17.1	17.1	18.1	1.0
AA	87,400[1]	349/200[3]	2,016	1.7	17.7	17.7	18.7	1.0
AB	88,300[1]	189/90[3]	1,380	2.5	18.0	18.0	19.0	1.0
AC	89,700[1]	174/50[3]	1,774	2.0	18.7	18.7	19.6	0.9
AD	91,100[1]	119/80[3]	1,362	2.2	19.1	19.1	20.0	0.9
Chocolate Bayou								
A	11,720[2]	465	5,732	2.4	*	3.8	4.8	1.0
B	17,820[2]	309	3,921	3.5	*	4.8	5.7	0.9
C	20,410[2]	327	4,139	3.3	*	5.3	6.2	0.9
D	23,620[2]	216	4,153	3.3	*	6.0	6.8	0.8
E	25,770[2]	213	4,107	3.3	*	6.3	7.1	0.8

[1]Feet above confluence with Intracoastal Waterway
[2]Feet above FM2004
[3]Width/width within county boundary
*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR LAKE CREEK - CHOCOLATE BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Chocolate Bayou (continued)								
F	30,850	215	3,491	3.8	*	7.1	7.9	0.8
G	33,650	249	3,311	4.0	*	7.9	8.6	0.7
H	37,100	284	3,203	4.3	*	9.1	9.8	0.7
I	42,200	600	4,439	3.1	*	10.7	11.5	0.8
J	47,200	700	3,701	3.8	*	12.9	13.8	0.9
K	53,300	1200	7,360	1.9	16.5	16.5	17.5	1.0
L	55,800	1024	8,862	1.6	17.2	17.2	18.2	1.0
M	58,100	1119	9,693	1.5	17.8	17.8	18.7	0.9
N	65,500	2,050	8,661	1.6	19.8	19.8	20.7	0.9
O	72,300	1,400	8,114	1.6	21.9	21.9	22.9	1.0
P	77,000	1,365	9,132	1.4	23.0	23.0	24.0	1.0
Q	83,700	1,350	4,177	3.0	23.8	23.8	24.8	1.0
R	90,600	946	7,065	1.7	24.9	24.9	25.9	1.0
S	94,800	737	7,104	1.6	26.3	26.3	27.3	1.0
T	97,200	1,088	8,805	1.3	27.4	27.4	28.3	0.9
U	101,600	1,740	14,553	0.8	28.0	28.0	28.9	0.9
V	109,300	1,600	8,946	1.3	29.2	29.2	30.1	0.9
W	117,600	2,400	1,996	6.0	33.1	33.1	34.1	1.0
X	122,100	2,928	17,391	0.7	34.5	34.5	35.4	0.9
Y	127,600	3,072	24,075	0.5	34.7	34.7	35.6	0.9
Z	133,600	1,338	7,028	1.5	35.2	35.2	36.1	0.9
AA	138,500	3,169	12,972	0.7	36.8	36.8	37.8	1.0
AB	143,100	1,453	7,397	1.1	37.9	37.9	38.9	1.0
AC	151,000	1,300	4,823	0.9	40.0	40.0	41.0	1.0
AD	155,200	2,172	8,736	0.5	40.4	40.4	41.4	1.0

[1]Feet above FM2004
*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

CHOCOLATE BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	[1] DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Chocolate Bayou (continued)								
AE	158,000	360	1,427	3.1	40.9	40.9	41.9	1.0
AF	158,800	750	3,826	1.2	42.4	42.4	43.4	1.0
AG	160,400	623	3,753	1.2	43.0	43.0	44.0	1.0
AH	162,300	406	1,378	3.2	43.9	43.9	44.9	1.0
AI	165,700	860	3,644	1.2	47.1	47.1	47.9	0.8
AJ	168,800	522	2,559	1.7	48.1	48.1	49.0	0.9
AK	170,300	393	2,133	2.1	48.8	48.8	49.7	0.9
AL	174,100	1,283	5,264	0.8	49.6	49.6	50.5	0.9
AM	178,500	477	2,045	2.2	51.7	51.7	52.7	1.0
AN	182,400	742	2,645	1.7	53.9	53.9	54.7	0.8

[1] Feet above FM2004

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

CHOCOLATE BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET) [2]	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1973 RELEVELING)			
Clear Creek								
A	143,715	454/29	4,159	1.3	32.4	32.4	33.3	0.9
B	146,233	1080/70	4,406	1.3	33.0	33.0	33.9	0.9
C	147,379	451/107	2,724	2.0	33.2	33.2	34.1	0.9
D	148,910	530/374	3,240	1.7	33.8	33.8	34.7	0.9
E	150,864	400/125	2,347	2.4	34.5	34.5	35.4	0.9
F	152,923	440/380	2,480	2.2	35.6	35.6	36.5	0.9
G	153,979	440/128	3,382	1.6	36.3	36.3	37.3	1.0
H	155,992	115/15	1,474	3.5	37.1	37.1	38.0	0.9
I	157,304	174/149	1,787	2.9	37.5	37.5	38.4	0.9
J	158,624	447/403	3,346	1.6	37.9	37.9	38.8	0.9
K	162,646	110/55	1,798	2.9	38.4	38.4	39.3	0.9
L	163,121	105/53	1,491	3.5	38.5	38.5	39.4	0.9
M	165,339	115/57	1,376	3.8	39.2	39.2	40.1	0.9
N	166,817	193/46	1,601	3.2	39.9	39.9	40.7	0.8
O	169,193	250/98	1,752	3.0	40.8	40.8	41.6	0.8
P	171,516	177/92	1,698	3.1	41.6	41.6	42.5	0.9
Q	171,986	85/37	850	6.1	41.6	41.6	42.5	0.9
R	172,995	261/191	2,521	2.1	42.6	42.6	43.4	0.8
S	173,523	281/200	2,675	1.9	42.7	42.7	43.5	0.8
T	173,840	256/184	2,301	2.3	42.7	42.7	43.5	0.8
U	173,946	162/87	1,861	2.8	42.7	42.7	43.5	0.8
V	173,999	162/87	1,861	2.8	42.7	42.7	43.5	0.8
W	174,474	346/290	2,119	2.5	42.9	42.9	43.7	0.8
X	174,496	346/290	2,119	2.5	42.9	42.9	43.7	0.8
Y	174,598	346/290	2,130	2.4	42.9	42.9	43.7	0.8
Z	175,673	160/78	1,808	2.9	43.2	43.2	44.1	0.9
AA	177,679	611/537	3,713	1.4	43.7	43.7	44.6	0.9

[1] Feet above confluence with Galveston Bay
[2] Width/width within county boundary

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

CLEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET) [2]	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1973 RELEVELING)			
Clear Creek (continued)								
AB	179,765	1237/1178	5,787	0.9	43.9	43.9	44.9	1.0
AC	179,976	1091/1028	6,635	0.8	44.0	44.0	45.0	1.0
AD	180,176	932/873	4,806	1.1	44.0	44.0	45.0	1.0
AE	181,982	754/676	4,305	1.1	44.3	44.3	45.3	1.0
AF	183,619	1247/1182	6,199	0.7	44.5	44.5	45.5	1.0
AG	185,045	101/41	1,375	3.2	44.6	44.6	45.6	1.0
AH	186,259	108/53	1,368	3.2	45.0	45.0	46.0	1.0
AI	186,945	127/57	1,520	2.9	45.2	45.2	46.2	1.0
AJ	187,790	140/63	1,571	2.8	45.5	45.5	46.5	1.0
AK	189,400	119/52	1,174	3.8	46.1	46.1	46.9	0.8
AL	190,403	473/68	3,138	1.4	46.5	46.5	47.4	0.9
AM	191,617	1635/768	7,375	0.6	46.6	46.6	47.5	0.9
AN	193,477	93/47	1,028	4.1	47.3	47.3	48.2	0.9
AO	194,375	120/60	1,155	3.6	48.0	48.0	48.8	0.8
AP	195,959	110/55	1,189	3.5	48.9	48.9	49.5	0.6
AQ	196,909	112/56	1,266	3.3	49.3	49.3	49.8	0.5
AR	197,859	101/51	1,049	4.0	49.6	49.6	50.2	0.6
AS	198,360	127/64	1,152	3.6	49.8	49.8	50.6	0.8
AT	198,465	190/124	1,875	2.2	49.8	49.8	50.6	0.8
AU	199,415	545/485	3,379	1.2	50.0	50.0	50.9	0.9
AV	200,603	703/63	3,946	1.1	50.2	50.2	51.1	0.9
AW	201,976	650/50	3,667	1.1	50.4	50.4	51.3	0.9
AX	203,639	630/69	2,899	1.4	50.9	50.8	51.7	0.9
AY	204,484	515/58	2,646	1.5	51.0	51.0	51.8	0.8
AZ	206,015	377/39	1,991	2.0	51.4	51.4	52.2	0.8
BA	206,913	1100/820	4,959	0.8	51.6	51.6	52.5	0.9

[1] Feet above confluence with Galveston Bay
[2] Width/width within county boundary

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

CLEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Clear Creek (continued)								
BB	208,497[1]	1160/729[3]	4,311	0.9	51.3	51.3	52.3	1.0
BC	210,247[1]	1010/352[3]	5,893	0.7	51.5	51.5	52.5	1.0
BD	211,831[1]	1292/35[3]	2,661	1.5	51.9	51.9	52.7	0.8
BE	214,207[1]	1800/27[3]	4,446	0.8	52.7	52.7	53.6	0.9
BF	214,721[1]	2020/35[3]	5,157	0.7	52.9	52.9	53.8	0.9
BG	215,755[1]	1900/37[3]	6,930	0.5	53.1	53.1	53.9	0.8
BH	217,339[1]	2600/52[3]	4,814	0.7	53.4	53.4	54.3	0.9
BI	218,131[1]	2950/50[3]	5,736	0.6	53.5	53.5	54.5	1.0
BJ	219,451[1]	2828/39[3]	5,435	0.6	53.8	53.8	54.8	1.0
BK	220,771[1]	2498/39[3]	4,414	0.7	54.5	54.5	55.1	0.6
BL	222,091[1]	1700/61[3]	4,213	0.8	54.7	54.7	55.5	0.8
BM	223,517[1]	1182/36[3]	2,944	1.0	55.1	55.1	56.1	1.0
BN	224,626[1]	680/110[3]	2,203	1.4	55.8	55.8	56.8	1.0
BO	225,629[1]	1230/795[3]	3,361	0.9	56.4	56.4	57.4	1.0
BP	227,552[1]	190/95[3]	1,846	1.5	56.8	56.8	57.7	0.9
BQ	229,294[1]	1070/160[3]	3,810	0.6	57.0	57.0	57.9	0.9
BR	231,036[1]	85/42[3]	687	3.6	57.4	57.4	58.4	1.0
BS	232,036[1]	150/30[3]	992	2.3	58.9	58.9	59.4	0.5
BT	233,418[1]	305/255[3]	1,441	1.4	59.2	59.2	60.1	0.9
BU	235,213[1]	330/180[3]	984	2.0	60.1	60.1	61.1	1.0
BV	237,167[1]	1500/1440[3]	3,265	0.6	60.8	60.8	61.8	1.0
Cocklebur Slough								
A	0.08[2]	318	1,108	1.7	*	6.2	7.2	1.0
B	0.50[2]	875	2,386	0.8	*	7.2	8.2	1.0

[1]Feet above confluence with Galveston Bay
[2]Miles above confluence with Cedar Lake Creek
[3]Width/width within county boundary
*Data not computed

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

CLEAR CREEK - COCKLEBUR SLOUGH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Cocklebur Slough (continued)								
C	1.68[1]	1,511	3,550	0.5	*	7.9	8.9	1.0
D	2.52[1]	1,838	4,038	0.5	*	8.4	9.4	1.0
E	3.49[1]	679	1,875	1.0	10.8	10.8	11.8	1.0
F	3.98[1]	1,340	3,611	0.4	11.2	11.2	12.2	1.0
G	23,750[2]	842	1,655	0.9	11.6	11.6	12.6	1.0
H	27,550[2]	603	1,376	0.9	12.8	12.8	13.8	1.0
I	30,550[2]	236	804	1.6	14.7	14.7	15.3	0.6
J	32,210[2]	245	926	1.4	15.9	15.9	16.2	0.3
K	33,160[2]	191	591	2.2	16.6	16.6	16.9	0.3
L	35,160[2]	216	556	0.6	17.9	17.9	18.4	0.5
M	38,260[2]	183	418	0.8	18.4	18.4	19.0	0.6
N	42,755[2]	39	245	1.1	21.8	21.8	22.6	0.8
O	44,900[2]	106	546	0.5	21.9	21.9	22.9	1.0
P	46,450[2]	107	418	0.6	21.9	21.9	22.9	1.0
Q	48,250[2]	102	339	0.8	22.6	22.6	23.2	0.6
R	50,470[2]	152	303	0.9	22.7	22.7	23.5	0.8
S	52,630[2]	221	395	0.5	23.1	23.1	23.8	0.7
T	54,030[2]	108	210	0.9	23.5	23.5	24.0	0.5
U	56,230[2]	108	331	0.6	23.5	23.5	24.0	0.5
V	58,440[2]	128	126	1.5	24.0	24.0	24.4	0.4
W	61,030[2]	34	88	1.5	25.3	25.3	25.7	0.4
X	62,980[2]	205	466	0.3	25.3	25.3	25.9	0.6
Y	65,460[2]	88	371	0.4	25.4	25.4	26.3	0.9
Z	68,010[2]	87	66	2.0	25.4	25.4	26.3	0.9
AA	70,840[2]	149	588	0.2	25.4	25.4	26.4	1.0

[1]Miles above confluence with Cedar Lake Creek
[2]Feet above confluence with Cedar Lake Creek
*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

COCKLEBUR SLOUGH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Cocklebur Slough (continued)								
AB	74,030[1]	166	592	0.2	25.5	25.5	26.5	1.0
AC	77,480[1]	130	245	0.5	27.9	27.9	28.0	0.1
Cow Creek								
A	2,480[2]	217/43[4]	2,084	3.3	*	29.6[5]	30.6	1.0
B	5,410[2]	137/91[4]	1,340	4.6	*	32.0[5]	32.5	0.5
C	9,260[2]	94/53[4]	987	6.3	*	35.2[5]	35.4	0.2
D	12,620[2]	120/61[4]	1,256	4.5	38.1	38.1	38.2	0.1
E	15,320[2]	96/48[4]	993	5.6	41.0	41.0	41.2	0.2
F	19,070[2]	353/201[4]	2,072	2.3	44.4	44.4	45.0	0.6
G	23,240[2]	287/112[4]	1,746	2.5	46.4	46.4	47.3	0.9
H	30,140[2]	309/193[4]	1,637	2.3	50.3	50.3	51.2	0.9
I	31,140[2]	1052/987[4]	4,477	0.8	50.7	50.7	51.6	0.9
J	33,190[2]	450/160[4]	2,263	1.7	51.1	51.1	52.0	0.9
K	35,260[2]	547/90[4]	2,489	1.5	51.9	51.9	52.8	0.9
L	37,700[2]	527/136[4]	2,574	1.5	52.8	52.8	53.7	0.9
M	39,400[2]	628/366[4]	2,680	1.4	53.4	53.4	54.4	1.0
N	42,900[2]	907/471[4]	4,468	0.9	54.5	54.5	55.5	1.0
Flores Bayou								
A	5,500[3]	123	1,214	3.6	11.1	11.1	12.1	1.0
B	10,400[3]	935	5,320	0.8	14.3	14.3	15.2	0.9
C	15,900[3]	598	3,031	1.3	17.5	17.5	18.5	1.0
D	21,100[3]	1,183	2,981	1.1	19.4	19.4	20.4	1.0
E	26,300[3]	866	3,207	1.0	20.8	20.8	21.8	1.0

[1]Feet above confluence with Cedar Lake Creek
[2]Feet above confluence with Brazos River
[3]Feet above confluence with Austin Bayou
[4]Width/width within county boundary
[5]Flooding controlled by Brazos River
*Undetermined

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

COCKLEBUR SLOUGH - COW CREEK - FLORES BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Flores Bayou (continued)								
F	26,400[1]	359	2,123	1.5	21.1	21.1	22.0	0.9
G	28,500[1]	893	3,233	1.0	21.7	21.7	22.7	1.0
H	29,500[1]	1,226	5,357	0.6	21.8	21.8	22.8	1.0
I	32,500[1]	129	768	4.1	22.2	22.2	23.1	0.9
J	35,400[1]	855	3,232	1.0	23.8	23.8	24.8	1.0
K	38,600[1]	1,121	3,681	0.8	24.7	24.7	25.6	0.9
L	41,600[1]	275	1,840	1.7	25.6	25.6	26.2	0.6
M	44,100[1]	412	1,427	1.9	26.1	26.1	26.9	0.8
N	47,200[1]	469	1,558	1.8	27.9	27.9	28.9	1.0
O	48,400[1]	967	3,893	0.7	28.3	28.3	29.2	0.9
P	51,900[1]	1,145	3,763	0.5	28.4	28.4	29.3	0.9
Q	55,700[1]	67	191	9.8	29.7	29.7	29.7	0.0
Halls Bayou								
A	16,855[2]	3,084	9,704	0.7	*	4.0	5.0	1.0
B	20,551[2]	484	2,841	2.3	*	4.5	5.5	1.0
C	24,247[2]	502	3,262	2.0	*	5.5	6.5	1.0
D	27,837[2]	1,213	5,711	1.1	*	6.1	7.1	1.0
E	31,586[2]	792/125[3]	5,079	1.3	*	6.5	7.5	1.0
F	35,018[2]	1478/150[3]	7,479	0.9	*	6.8	7.8	1.0
G	38,767[2]	3641/1780[3]	14,777	0.4	*	7.0	8.0	1.0
H	42,516[2]	1,841	8,941	0.6	*	7.1	8.1	1.0
I	45,631[2]	475	3,119	1.7	*	7.3	8.3	1.0
J	49,274[2]	489	3,544	1.5	*	7.9	8.9	1.0
K	50,700[2]	279	2,147	2.3	*	9.0	10.0	1.0

[1]Feet above confluence with Austin Bayou

[2]Feet above confluence with Halls Lake

[3]Width/width within county boundary

*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevation

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

FLORES BAYOU - HALLS BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Halls Bayou (continued)								
L	53,500[1]	329	3,433	1.4	*	9.2	10.2	1.0
M	56,300[1]	350	3,079	1.6	*	9.4	10.4	1.0
N	60,100[1]	352	3,422	1.2	*	9.6	10.6	1.0
O	65,000[1]	146	1,787	2.4	*	9.9	10.8	0.9
P	69,700[1]	123	1,383	3.1	11.4	11.4	12.1	0.7
Q	73,200[1]	100	1,211	3.2	12.9	12.9	13.6	0.7
R	75,000[1]	110	1,296	3.0	13.9	13.9	14.6	0.7
S	77,500[1]	222	2,273	1.6	14.5	14.5	15.1	0.6
T	80,800[1]	107	1,243	2.3	14.9	14.9	15.5	0.6
U	85,100[1]	76	641	3.6	15.9	15.9	16.5	0.6
V	90,900[1]	48	335	5.2	21.7	21.7	21.7	0.0
W	93,400[1]	73	447	3.4	24.8	24.8	25.0	0.2
X	94,700[1]	74	1,009	1.5	27.1	27.1	27.8	0.7
Y	99,000[1]	169	872	1.0	27.3	27.3	28.1	0.8
Hayes Creek								
A	3,020[2]	195	689	2.4	35.7	35.7	36.7	1.0
B	6,270[2]	528	1,258	1.3	37.8	37.8	38.5	0.7
C	7,900[2]	665	1,510	1.1	38.4	38.4	38.9	0.5
D	9,870[2]	30	270	6.1	40.9	40.9	41.7	0.8
E	11,650[2]	523	1,665	1.0	42.1	42.1	43.1	1.0
F	14,220[2]	535	659	2.5	43.3	43.3	43.8	0.5
G	18,130[2]	256	885	1.9	45.6	45.6	46.4	0.8
H	20,880[2]	63	424	3.0	46.4	46.4	47.3	0.9
I	24,200[2]	96	840	1.3	48.1	48.1	48.7	0.6

[1]Feet above confluence with Halls Lake
[2]Feet above confluence with Chocolate Bayou
*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevation

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

HALL BAYOU - HAYES CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Hayes Creek (continued)								
J	24,770[1]	35	296	3.8	48.5	48.5	48.9	0.4
K	28,720[1]	309	743	1.1	50.8	50.8	51.7	0.9
L	30,320[1]	152	566	1.5	51.6	51.6	52.5	0.9
M	32,120[1]	292	932	0.9	52.2	52.2	53.1	0.9
N	34,810[1]	321	769	0.8	53.6	53.6	54.6	1.0
O	37,260[1]	54	158	3.9	54.6	54.6	55.5	0.9
Linnville Bayou								
A	35,050[2]	596/400[3]	4,098	1.5	27.4	27.4	28.4	1.0
B	41,890[2]	788/280[3]	5,007	1.2	28.4	28.4	29.4	1.0
C	52,690[2]	549/380[3]	5,278	1.2	29.7	29.7	30.6	0.9
D	57,810[2]	305/160[3]	2,880	2.1	30.5	30.5	31.4	0.9
E	64,450[2]	172/90[3]	2,554	1.8	32.3	32.3	33.1	0.8
F	68,450[2]	482/110[3]	3,524	1.3	32.8	32.8	33.6	0.8
G	72,060[2]	393/90[3]	4,450	1.1	33.1	33.1	34.0	0.9
H	77,360[2]	975/100[3]	7,131	0.7	33.3	33.3	34.2	0.9
I	81,880[2]	489/210[3]	4,210	1.1	33.6	33.6	34.5	0.9
J	84,590[2]	1002/180[3]	7,464	0.6	34.1	34.1	35.0	0.9
K	86,270[2]	682/475[3]	3,357	1.3	34.4	34.4	35.3	0.9
L	91,770[2]	084/1010[3]	3,563	1.2	35.9	35.9	36.9	1.0
M	99,920[2]	1177/930[3]	4,464	1.0	37.9	37.9	38.9	1.0
N	103,020[2]	978/130[3]	6,257	0.7	38.4	38.4	39.4	1.0
O	105,230[2]	1104/750[3]	5,983	0.7	38.6	38.6	39.6	1.0
P	109,030[2]	1281/930[3]	5,576	0.8	38.9	38.9	39.9	1.0
Q	112,030[2]	942/520[3]	3,720	1.2	39.4	39.4	40.3	0.9

[1]Feet above confluence with Chocolate Bayou
[2]Feet above confluence with Caney Creek
[3]Width/width within county boundary

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

HAYES CREEK - LINNVILLE BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Linnville Bayou (continued)								
R	117,410	935/500	3,885	1.1	40.6	40.6	41.6	1.0
S	120,550	976/580	4,023	1.1	41.3	41.3	42.3	1.0
T	123,650	121/80	1,434	3.1	42.2	42.2	43.2	1.0
U	126,650	751/130	3,325	1.3	43.3	43.3	44.3	1.0
V	127,460	957/250	3,683	1.2	43.5	43.5	44.5	1.0
W	130,560	475/140	2,540	1.7	44.2	44.2	45.2	1.0
X	134,310	179/80	1,724	2.6	45.7	45.7	46.7	1.0
Y	138,490	140/90	1,930	2.3	46.7	46.7	47.7	1.0

[1]Feet above confluence with Caney Creek
[2]Width/width within county boundary

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

LINNVILLE BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1973 RELEVELING)			
Marys Creek								
A	12,360	97	652	1.4	32.9	32.9	33.9	1.0
B	12,890	42	279	3.4	33.6	33.6	34.4	0.8
C	14,220	98	549	1.7	35.4	35.4	36.2	0.8
D	15,450	43	338	2.8	36.2	36.2	37.1	0.9
E	17,760	41	307	3.1	39.2	39.2	40.2	1.0
F	19,900	44	420	2.2	42.3	42.3	43.3	1.0
G	21,680	101	492	1.9	42.5	42.5	43.5	1.0
H	23,210	221	1,315	1.6	43.9	43.9	44.9	1.0
I	25,430	97	876	2.3	45.5	45.5	46.4	0.9
J	26,890	273	1,673	1.2	45.8	45.8	46.8	1.0
K	29,190	62	644	2.7	46.5	46.5	47.5	1.0
L	30,320	79	854	2.0	47.0	47.0	47.9	0.9
M	30,650	321	1,385	1.2	47.1	47.1	48.0	0.9
N	33,120	447	1,484	1.2	47.4	47.4	48.3	0.9
O	35,100	323	1,049	1.6	47.7	47.7	48.6	0.9
P	35,750	73	706	2.4	48.1	48.1	49.0	0.9
Q	37,050	73	476	3.6	48.8	48.8	49.8	1.0
R	37,950	54	428	4.0	49.2	49.2	50.2	1.0
S	39,930	58	508	3.4	50.0	50.0	50.6	0.6
T	42,560	253	1,288	1.0	50.4	50.4	51.4	1.0
U	44,890	222	1,019	1.3	50.7	50.7	51.7	1.0

[1]Feet above confluence with Clear Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

MARYS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Marys Creek (continued)								
V	45,700	227	667	2.0	50.7	50.7	51.7	1.0
W	47,370	56	513	2.6	51.6	51.6	52.6	1.0
X	50,720	208	490	1.3	52.5	52.5	53.5	1.0
Y	53,820	124	385	1.6	53.8	53.8	54.7	0.9
Z	56,380	410	884	0.7	54.4	54.4	55.4	1.0
AA	59,130	370	587	1.0	54.9	54.9	55.9	1.0

[1]Feet above confluence with Clear Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

MARYS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	[1] DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1973 RELEVELING)			
Marys Creek By-Pass Channel								
A	1,200	224	683	1.6	37.4	37.4	37.9	0.5
B	4,200	240	692	1.6	37.7	37.7	38.6	0.9
C	5,600	*	348	3.2	38.1	38.1	39.1	1.0
D	8,100	*	504	2.2	40.0	40.0	40.5	0.5
E	8,400	*	383	2.9	40.3	40.3	40.8	0.5
F	9,350	*	336	3.3	41.0	41.0	41.4	0.4
G	11,050	*	391	2.8	42.4	42.4	42.6	0.2
H	11,800	*	456	2.4	42.9	42.9	43.1	0.2

[1] Feet above confluence with Marys Creek
*Floodway coincident with channel banks

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

MARYS CREEK BY-PASS CHANNEL

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Mound Creek								
A	1,100	107	1,532	3.6	30.7	18.7[2]	19.7	1.0
B	2,410	383	3,353	1.6	30.7	19.3[2]	20.3	1.0
C	4,910	211	2,688	2.0	30.7	20.2[2]	21.2	1.0
D	6,180	578	4,155	1.3	30.7	20.6[2]	21.6	1.0
E	7,500	365	3,185	1.7	30.7	20.8[2]	21.8	1.0
F	9,000	134	2,219	2.2	30.7	21.2[2]	22.2	1.0
G	12,630	200	1,772	2.7	30.7	22.4[2]	23.4	1.0
H	14,580	226	1,860	2.6	30.7	24.2[2]	25.2	1.0
I	18,080	186	1,892	2.5	30.7	29.0[2]	29.9	0.9
J	20,880	614	4,090	1.2	30.7	30.7	31.7	1.0
K	23,030	287	2,382	2.0	31.7	31.7	32.7	1.0
L	25,100	80	1,372	3.1	33.9	33.9	34.9	1.0
M	26,830	297	2,428	1.8	35.7	35.7	36.5	0.8
N	28,580	292	2,614	1.6	36.9	36.9	37.7	0.8
O	31,230	249	2,316	1.9	38.1	38.1	39.0	0.9
P	33,330	371	3,065	1.4	39.1	39.1	40.1	1.0
Q	35,730	493	3,134	1.4	40.2	40.2	41.2	1.0
R	37,380	276	1,954	2.2	41.6	41.6	42.6	1.0
S	40,020	387	2,900	1.5	43.8	43.8	44.8	1.0
T	42,630	434	2,898	1.5	45.2	45.2	46.2	1.0
U	45,030	619	2,455	1.8	46.7	46.7	47.7	1.0
V	46,910	756	3,829	1.1	47.5	47.5	48.5	1.0

[1]Feet above confluence with San Bernard River
[2]Elevation computed without consideration of backwater effects from San Bernard River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

MOUND CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Mustang Bayou								
A	34,700	1,120	4,388	1.4	*	12.6	13.5	0.9
B	37,900	1,712	6,207	1.0	*	13.1	14.0	0.9
C	41,500	900	4,773	1.3	*	13.5	14.5	1.0
D	45,800	706	3,259	1.9	*	14.2	15.2	1.0
E	52,100	1,693	6,577	0.9	*	15.2	16.2	1.0
F	56,600	116	1,311	4.6	16.0	16.0	17.0	1.0
G	60,400	97	1,244	4.8	18.2	18.2	19.0	0.8
H	64,800	73	1,133	5.2	21.1	21.1	21.7	0.6
I	68,000	85	1,298	4.5	22.8	22.8	23.5	0.7
J	70,900	1,052	4,783	1.2	23.6	23.6	24.5	0.9
K	73,700	533	2,260	2.3	24.2	24.2	25.1	0.9
L	77,800	124	1,451	3.6	25.8	25.8	26.5	0.7
M	78,700	246	1,685	3.1	27.3	27.3	27.8	0.5
N	79,500	278	2,003	2.6	28.2	28.2	28.8	0.6
O	80,100	581	2,774	1.9	28.3	28.3	29.0	0.7
P	82,100	371	2,249	2.3	28.7	28.7	29.5	0.8
Q	85,400	88	1,273	4.0	29.3	29.3	30.2	0.9
R	86,500	842	4,504	1.1	30.2	30.2	31.0	0.8
S	88,200	764	4,602	1.1	30.7	30.7	31.5	0.8
T	90,200	162	1,939	2.5	31.3	31.3	32.1	0.8
U	91,300	600	2,796	1.8	31.7	31.7	32.6	0.9
V	94,000	100	1,149	4.3	32.3	32.3	33.2	0.9
W	96,800	300	3,133	1.6	33.3	33.3	34.3	1.0
X	100,200	83	969	4.9	34.0	34.0	35.0	1.0
Y	101,400	390	2,092	2.3	34.9	34.9	35.8	0.9
Z	103,300	89	1,002	4.7	35.5	35.5	36.4	0.9

[1]Feet above confluence with Chocolate Bay

*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

MUSTANG BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Mustang Bayou (continued)								
AA	104,900	86	996	4.7	36.9	36.9	37.6	0.7
AB	106,700	218	1,419	3.3	38.2	38.2	38.8	0.6
AC	108,400	147	1,247	3.8	38.9	38.9	39.6	0.7
AD	110,200	105	1,654	2.9	40.8	40.8	41.6	0.8
AE	113,000	74	791	4.6	41.3	41.3	42.2	0.9
AF	113,800	77	1,011	3.6	42.2	42.2	43.0	0.8
AG	116,200	123	1,418	2.2	42.8	42.8	43.6	0.8
AH	116,700	115	1,584	2.0	42.9	42.9	43.7	0.8
AI	117,750	111	1,310	2.4	43.4	43.4	44.3	0.9
AJ	118,950	220	1,718	1.8	43.9	43.9	44.7	0.8
AK	120,000	639	2,896	1.1	44.0	44.0	44.8	0.8
AL	120,700	454	2,429	1.3	44.5	44.5	45.2	0.7
AM	121,500	625	3,520	0.9	44.7	44.7	45.5	0.8
AN	123,000	943	4,652	0.5	44.8	44.8	45.6	0.8
AO	125,300	182	1,228	2.0	46.5	46.5	46.8	0.3
AP	127,300	502	2,838	0.8	46.6	46.6	47.1	0.5
AQ	128,900	409	2,059	1.1	46.7	46.7	47.4	0.7
AR	130,300	178	592	3.8	46.7	46.7	47.6	0.9
AS	131,150	40	433	5.2	47.5	47.5	48.5	1.0
AT	133,200	218	1,465	1.5	48.5	48.5	49.4	0.9
AU	134,850	316	1,883	1.2	48.7	48.7	49.6	0.9
AV	136,100	118	881	2.5	48.9	48.9	49.9	1.0
AW	137,200	360	1,467	1.5	49.1	49.1	50.1	1.0
AX	139,800	526	3,234	0.6	49.4	49.4	50.4	1.0
AY	140,400	549	3,325	0.6	49.5	49.5	50.5	1.0

[1]Feet above confluence with Chocolate Bay

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

MUSTANG BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Mustang Bayou (continued)								
AZ	142,200	838	4,586	0.4	49.5	49.5	50.5	1.0
BA	142,600	607	3,458	0.6	49.6	49.6	50.6	1.0
BB	145,200	206	1,146	1.8	49.7	49.7	50.7	1.0
BC	145,800	223	1,294	1.6	49.9	49.9	50.9	1.0
BD	148,600	276	1,608	1.3	50.8	50.8	51.6	0.8
BE	151,800	344	1,867	1.1	51.2	51.2	52.0	0.8
BF	156,300	168	861	1.8	51.8	51.8	52.6	0.8
BG	158,600	93	671	2.3	52.4	52.4	53.1	0.7
BH	161,200	143	744	2.1	53.2	53.2	54.0	0.8
BI	164,700	554	2,066	0.8	53.6	53.6	54.4	0.8
BJ	166,600	472	2,027	0.8	53.8	53.8	54.6	0.8
BK	168,200	460	1,658	0.9	53.9	53.9	54.8	0.9
BL	170,800	234	1,065	1.4	56.3	56.3	57.3	1.0
BM	173,200	300	1,004	1.3	57.0	57.0	57.7	0.7
BN	175,600	67	357	3.6	58.8	58.8	59.4	0.6
BO	176,800	133	850	1.5	59.1	59.1	59.9	0.8
BP	180,000	211	854	1.5	59.6	59.6	60.5	0.9
BQ	184,200	284	1,044	1.2	60.5	60.5	61.3	0.8
BR	186,000	388	1,065	1.2	61.0	61.0	61.9	0.9
BS	187,600	548	2,294	0.6	62.0	62.0	62.9	0.9
BT	190,700	355	1,047	1.2	62.5	62.5	63.3	0.8
BU	192,500	400	1,899	0.7	62.8	62.8	63.6	0.8
BV	196,200	267	1,272	1.0	63.2	63.2	64.0	0.8
BW	199,600	291	660	1.8	64.4	64.4	65.1	0.7
BX	202,600	402	1,525	0.8	64.6	64.6	65.5	0.9

[1]Feet above confluence with Chocolate Bay

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Mustang Bayou (continued)								
BY	205,400[1]	583	1,510	0.8	64.7	64.7	65.6	0.9
BZ	206,600[1]	60	497	2.5	65.4	65.4	66.4	1.0
CA	208,600[1]	70	648	1.9	65.6	65.6	66.6	1.0
CB	211,700[1]	291	1,386	0.9	65.9	65.9	66.9	1.0
CC	215,400[1]	57	329	3.6	66.6	66.6	67.6	1.0
CD	216,800[1]	61	416	2.8	67.4	67.4	68.2	0.8
CE	217,600[1]	59	414	2.8	67.7	67.7	68.4	0.7
CF	218,900[1]	65	563	2.1	68.2	68.2	68.9	0.7
CG	220,800[1]	139	780	1.5	68.4	68.4	69.1	0.7
Oyster Creek								
A	1.1[2]	453	2,989	1.6	*	3.1	4.1	1.0
B	2.2[2]	492	3,077	1.5	*	3.6	4.4	0.8
C	3.0[2]	350	2,018	2.3	*	4.0	4.7	0.7
D	5.5[2]	301	2,298	2.3	*	5.2	5.7	0.5
E	7.0[2]	171	1,439	3.8	*	6.6	6.9	0.3
F	8.3[2]	196	1,684	3.3	*	8.4	8.6	0.2
G	9.4[2]	241	1,810	3.1	*	9.5	9.7	0.2
H	11.8[2]	362	2,649	2.2	10.8	10.8	11.1	0.3
I	15.0[2]	122	1,897	3.1	12.6	12.6	13.0	0.4
J	17.5[2]	192	2,058	2.8	13.9	13.9	14.2	0.3
K	21.3[2]	213	2,441	2.4	15.8	15.8	16.0	0.2
L	22.0[2]	205	2,480	2.5	16.2	16.2	16.4	0.2
M	23.1[2]	218	2,498	2.6	16.7	16.7	16.9	0.2
N	25.6[2]	206	2,264	3.3	17.9	17.9	18.0	0.1

[1] Feet above confluence with Chocolate Bay
[2] Miles above confluence with Intracoastal Waterway
* Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

MUSTANG BAYOU - OYSTER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Oyster Creek (continued)								
O	27.2[1]	165	1,951	4.3	19.6	19.6	19.7	0.1
P	29.6[1]	337	4,205	2.6	22.2	22.2	23.0	0.8
Q	32.4[1]	236	3,124	2.9	25.0	25.0	25.8	0.8
R	34.5[1]	247	3,672	3.6	26.0	26.0	26.7	0.7
San Bernard River								
A	0.73[1]	4,658	25,488	1.3	*	6.5	7.5	1.0
B	3.78[1]	12,297	49,182	0.7	*	8.1	9.1	1.0
C	5.72[1]	9,794	48,583	0.7	*	8.5	9.5	1.0
D	7.88[1]	5,157	29,074	1.2	*	9.0	10.0	1.0
E	52,800[2]	3,149	15,147	2.1	10.6	10.6	11.6	1.0
Stevenson Slough								
A	5,640[3]	79	350	1.9	23.6	18.1[4]	19.1	1.0
B	6,260[3]	8	93	7.2	23.6	20.2[4]	20.8	0.6
C	7,800[3]	13	114	5.4	23.6	22.3[4]	22.7	0.4
D	8,010[3]	53	266	2.3	25.0	25.0	25.6	0.6
E	9,060[3]	207	1,412	0.4	25.2	25.2	26.2	1.0
F	10,810[3]	52	306	2.0	26.2	26.2	27.0	0.8
G	12,145[3]	41	254	2.4	26.8	26.8	27.8	1.0
H	13,485[3]	115	632	0.4	27.0	27.0	28.0	1.0
I	13,723[3]	119	565	0.5	27.0	27.0	28.0	1.0
J	14,089[3]	53	185	1.5	27.1	27.1	28.1	1.0
K	14,501[3]	143	554	0.5	27.2	27.2	28.2	1.0
L	14,731[3]	75	214	1.3	27.2	27.2	28.2	1.0

[1]Miles above confluence with Intracoastal Waterway
[2]Feet above confluence with Intracoastal Waterway
[3]Feet above confluence with San Bernard River
[4]Elevation computed without consideration of backwater effects from San Bernard River
*Controlled by tidal flooding - see Flood Insurance Rate Map for applicable elevations

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

OYSTER CREEK - SAN BERNARD RIVER - STEVENSON SLOUGH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Stevenson Slough (continued)								
M	15,432[1]	75	182	1.5	28.0	28.0	28.6	0.6
N	15,693[1]	33	124	2.2	28.3	28.3	29.2	0.9
O	16,047[1]	89	192	1.4	28.9	28.9	29.8	0.9
P	16,513[1]	75	217	1.2	29.6	29.6	30.4	0.8
Q	17,984[1]	34	111	1.2	30.3	30.3	31.2	0.9
R	18,220[1]	145	566	0.2	31.8	31.8	32.6	0.8
S	18,420[1]	145	567	0.2	31.8	31.8	32.6	0.8
T	20,148[1]	88	343	0.4	31.9	31.9	32.7	0.8
U	21,290[1]	274	1,968	0.1	36.6	36.6	37.4	0.8
V	21,760[1]	586	2,518	0.1	36.6	36.6	37.4	0.8
W	22,290[1]	140	967	0.1	36.6	36.6	37.4	0.8
X	24,982[1]	218	1,642	0.1	36.7	36.7	37.5	0.8
Y	26,682[1]	202	850	0.2	36.7	36.7	37.5	0.8
Z	28,582[1]	189	1,336	0.1	36.7	36.7	37.6	0.9
Unnamed Tributary to Chocolate Bayou								
A	3,240[2]	277	1,231	0.9	37.2	37.2	38.1	0.9
B	3,640[2]	194	929	1.2	37.2	37.2	38.2	1.0
C	6,770[2]	45	290	3.4	38.7	38.7	39.6	0.9
D	7,270[2]	45	319	3.1	39.9	39.9	40.7	0.8
E	10,600[2]	269	630	1.5	41.8	41.8	42.7	0.9
F	13,400[2]	177	526	1.8	43.4	43.4	44.3	0.9
G	14,300[2]	205	593	1.6	44.0	44.0	44.9	0.9

[1]Feet above confluence with San Bernard River
[2]Feet above confluence with Chocolate Bayou

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

STEVENSON SLOUGH - UNNAMED TRIBUTARY TO CHOCOLATE BAYOU

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Unnamed Tributary to Chocolate Bayou (continued)								
H	17,362[1]	285	715	1.2	44.8	44.8	45.8	1.0
I	19,713[1]	81	379	2.2	47.4	47.4	48.4	1.0
J	22,410[1]	344	955	0.9	48.2	48.2	49.2	1.0
K	26,340[1]	386	582	1.2	48.8	48.8	49.8	1.0
L	27,990[1]	190	470	1.5	49.3	49.3	50.2	0.9
M	30,400[1]	88	237	1.7	51.1	51.1	51.9	0.8
Varner Creek								
A	8,980[2]	122	1,048	6.3	28.9	28.5[3]	28.5	0.0
B	11,280[2]	322	2,426	2.8	30.3	30.3	30.5	0.2
C	13,230[2]	90	1,060	6.4	30.9	30.9	31.2	0.3
D	14,440[2]	152	2,106	3.2	31.9	31.9	32.2	0.3
E	15,680[2]	163	1,780	3.8	32.3	32.3	32.6	0.3
F	19,180[2]	1,670	12,491	0.5	32.5	32.5	33.1	0.6
G	20,280[2]	1,962	15,601	0.4	32.5	32.5	33.1	0.6
H	22,980[2]	1,119	9,989	0.4	32.5	32.5	33.2	0.7
I	25,080[2]	798	8,371	0.4	32.5	32.5	33.2	0.7
J	29,680[2]	997	8,468	0.4	32.5	32.5	33.2	0.7
K	31,980[2]	475	3,306	0.9	32.6	32.6	33.4	0.8
L	34,780[2]	665	4,925	0.6	32.6	32.6	33.5	0.9
M	37,180[2]	416	2,367	1.3	32.8	32.8	33.7	0.9
N	39,830[2]	280	1,273	2.4	33.8	33.8	34.8	1.0
O	41,530[2]	389	1,691	1.2	34.4	34.4	35.4	1.0

[1]Feet above confluence with Chocolate Bayou
[2]Feet above confluence with Brazos River
[3]Elevation computed without consideration of backwater effects from Brazos River

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY TO CHOCOLATE BAYOU · VARNER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD-1979 RELEVELING)			
Varner Creek (continued)								
P	43,050[1]	137	963	2.2	34.6	34.6	35.6	1.0
Q	46,560[1]	221	1,135	1.4	37.5	37.5	37.9	0.4
R	49,240[1]	208	627	2.6	38.2	38.2	38.7	0.5
S	51,750[1]	100	661	2.4	40.6	40.6	41.3	0.7
T	54,230[1]	168	851	1.9	41.6	41.6	42.4	0.8
U	57,640[1]	151	677	2.4	43.4	43.4	44.2	0.8
V	61,730[1]	222	762	2.1	46.6	46.6	47.6	1.0
West Fork Chocolate Bayou								
A	2,150[2]	610	3,168	1.2	40.3	40.3	41.2	0.9
B	5,300[2]	618	3,133	1.2	41.0	41.0	41.9	0.9
C	8,250[2]	808	2,938	1.1	42.7	42.7	43.3	0.6
D	9,050[2]	600	2,100	1.6	43.2	43.2	43.8	0.6
E	12,800[2]	633	2,777	1.2	45.1	45.1	45.9	0.8
F	17,550[2]	860	3,106	0.8	46.4	46.4	47.3	0.9
G	19,460[2]	516	1,662	1.5	47.2	47.2	48.1	0.9
H	23,390[2]	313	1,620	1.5	49.3	49.3	50.2	0.9
I	27,700[2]	377	1,203	1.9	51.6	51.6	52.6	1.0
J	32,040[2]	299	975	2.4	54.3	54.3	55.3	1.0
K	35,320[2]	514	2,326	0.9	56.3	56.3	57.2	0.9
L	37,800[2]	917	3,723	0.5	56.8	56.8	57.7	0.9
M	39,910[2]	851	3,125	0.4	57.0	57.0	57.9	0.9
N	43,720[2]	591	2,012	0.5	57.4	57.4	58.3	0.9
O	47,600[2]	131	495	2.0	58.5	58.5	59.5	1.0
P	50,600[2]	442	1,439	0.7	60.3	60.3	61.3	1.0

[1]Feet above confluence with Brazos River
[2]Feet above confluence with Chocolate Bayou

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

FLOODWAY DATA

VARNER CREEK - WEST FORK CHOCOLATE BAYOU

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 6 for certain downstream cross sections of Bell Creek, Brushy Bayou, Mound Creek, Stevenson Slough, and Varner Creek are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

4.3 Depth Criteria

Another floodplain management tool designed to assist communities in balancing the economic gain from floodplain development against the resulting increase in flood hazard is the depth criterion. Under this criterion, floodplain areas shallower than a specified depth, as measured from the 100-year regulatory flood elevation, may be developed, while floodplain areas inundated by greater depths of flooding must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. Typical relationships between shallow and deep areas of the floodplain and their significance to floodplain development are shown in Figure 5.

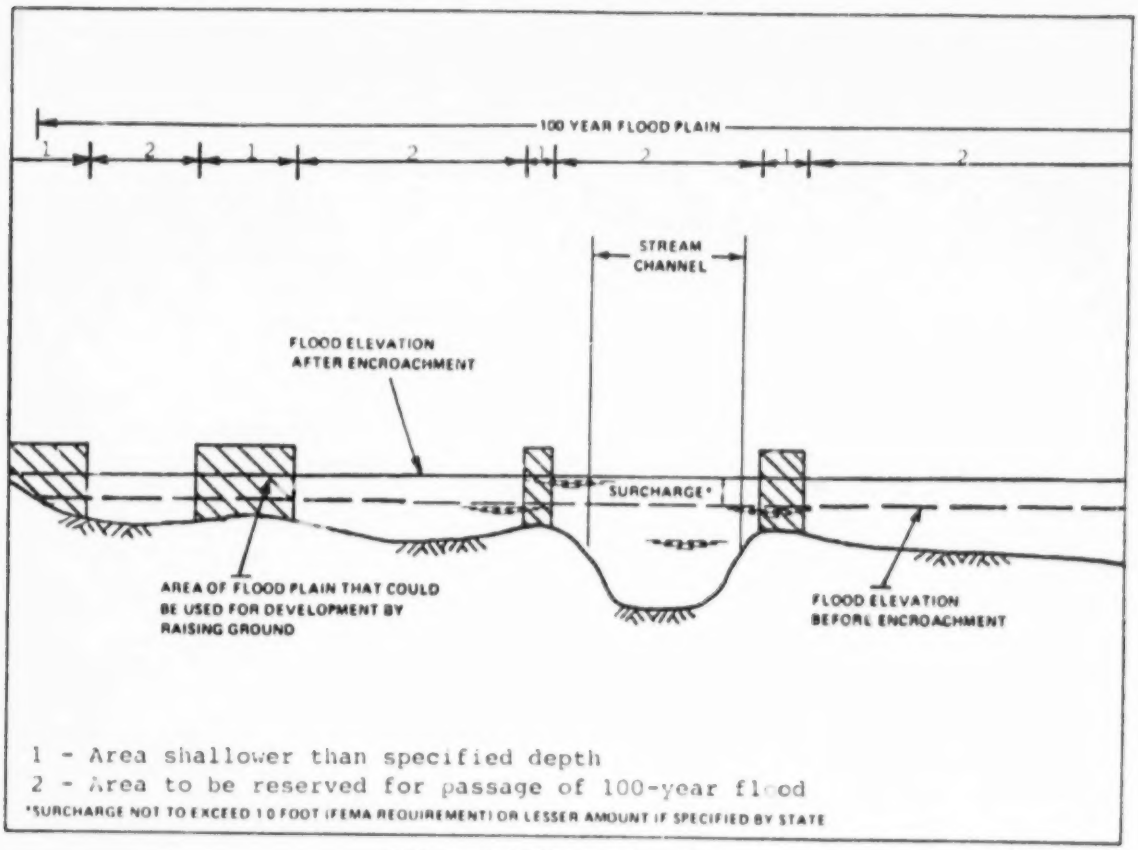
Since the areas deeper than a specified depth are not shown on the Flood Insurance Rate Map, a community enforcing a depth criterion assumes an added responsibility. Specifically, the community must assure the following:

- That the depth of flooding at a property, as measured from the 100-year regulatory flood elevation, has been appropriately determined,
- that the development will not impede natural flood flow paths, and
- that emergency access to the property remains viable during a 100-year flood.

Depth criteria were computed for three streams; the results are given in Table 7.

Table 7 - Depth Criteria

Flooding Source	Depth Criterion (feet)	Location
Brazos River	3.0	Upstream of the confluence of Buffalo Camp Bayou (Mile 14.5)
Oyster Creek	1.5	Upstream of the Missouri-Pacific Railroad (Mile 19.8)
San Bernard River	2.5	Upstream of FM 2611


100 YEAR FLOOD PLAIN
1
2
1
2
1
2
1
2
STREAM CHANNEL
FLOOD ELEVATION AFTER ENCROACHMENT
SURCHARGE*
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT
1 - Area shallower than specified depth
2 - Area to be reserved for passage of 100-year flood
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

DEPTH CRITERIA SCHEMATIC Figure 5

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain,and to areas of 100-year flooding where average depths are less than 1 foot, areas of 10-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

The current Flood Insurance Rate Map represents flooding information for the entire geographic area of Brazoria County. Previously, separate Flood Insurance Rate Maps were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county, with the exception of the Town of Holiday Lakes. Historical data relating to the maps prepared for each community are presented in Table 8, "Community Map History."

7.0 OTHER STUDIES

The results presented within this Flood Insurance Study conflict in some respects with the following published reports: Flood Plain Information, Chocolate Bayou, Brazoria County, Texas (Reference 50); Flood Plain Information, Brazos River, Fort Bend County, Texas (Reference 51); Special Flood Hazard Information, Clear Creek, Brazoria, Fort Bend, Galveston, and Harris County, Texas (Reference 52); and Survey Report on San Bernard River, Texas Flood Control (Reference 53). The differences between this study and the studies referenced above result from the use of more up to date field data being used in this study; further, a detailed analysis of the hydrology and hydraulics of each flooding source was made in this study.

The COE conducted a study on estimating hurricane surge frequency for the Texas Gulf Coast in 1969 (Reference 54). Open coast surge frequency curves were developed for Sabine to Port Isabel. Another study was made by the COE in 1970 for FEMA to conduct a Flood Insurance Study along the Texas Coast (Reference 2). This study, extending from Sabine Lake to Matagorda Bay, included approximately 240 miles of the upper Texas

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Alvin, City of	February 19, 1972	None	February 19, 1972	July 1, 1974 October 31, 1975 June 11, 1976 September 28, 1979 March 24, 1981 July 19, 1982 July 16, 1987 June 5, 1989
Angleton, City of	June 28, 1974	July 1, 1974	June 10, 1977	January 27, 1978 July 5, 1982 June 5, 1989
Bailey's Prairie, Village of	November 8, 1974	October 22, 1976	December 15, 1983	June 5, 1989
Bonney, Village of	May 8, 1971	None	July 1, 1974	June 10, 1977 March 15, 1984 June 5, 1989
Brazoria, City of	January 9, 1974	May 21, 1976	December 15, 1983	June 5, 1989

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Brazoria County, Unincorporated Areas	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 October 27, 1978 October 1, 1983 August 19, 1986 June 5, 1989
Brookside Village, City of	June 28, 1974	June 18, 1976	November 1, 1984	November 15, 1985 June 5, 1989
Clute, City of	May 10, 1974	None	December 7, 1976	December 1, 1983 June 5, 1989
Danbury, City of	May 24, 1974	June 11, 1976	September 16, 1981	June 5, 1989
Freeport, City of	November 17, 1970	None	November 17, 1970	July 1, 1974 October 31, 1975 January 17, 1986 June 5, 1989
Hillcrest Village, City of	March 18, 1972	None	March 18, 1972	July 1, 1974 April 11, 1975 July 19, 1982 June 5, 1989

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
[1]Holiday Lakes, Town of	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 October 27, 1978 August 19, 1986 June 5, 1989
Iowa Colony, City of	July 2, 1976	None	May 17, 1982	August 19, 1986 June 5, 1989
Jones Creek, Village of	May 24, 1974	January 2, 1976	June 5, 1985	June 5, 1989
Lake Jackson, City of	July 7, 1972	None	July 7, 1972	July 1, 1974 July 25, 1975 March 18, 1977 July 3, 1985 June 5, 1989
Liverpool, City of	November 26, 1976	None	June 5, 1985	June 5, 1989
Manvel, City of	December 20, 1974	None	December 1, 1981	June 5, 1989
Oyster Creek, Village of	May 8, 1971	July 1, 1974	November 19, 1976	June 5, 1989

[1]Flood hazard information previously shown in Brazoria County's Flood Insurance Study and Flood Insurance Rate Map

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Pearland, City of	January 31, 1975	August 13, 1976	July 5, 1984	June 5, 1989
Quintana, Village of	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 June 5, 1985 June 5, 1989
Richwood, City of	July 28, 1972	None	July 28, 1972	July 1, 1974 November 28, 1975 January 6, 1976 November 24, 1981 December 1, 1983 April 3, 1985 June 5, 1989
Surfside Beach, Village of	May 8, 1971	None	May 8, 1971	July 1, 1974 June 10, 1977 June 5, 1985 June 5, 1989

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Sweeny, City of	December 23, 1971	None	December 23, 1971	July 1, 1974 August 22, 1975 December 1, 1982 June 5, 1989
West Columbia, City of	June 14, 1974	January 16, 1976	December 15, 1983	June 5, 1989

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

BRAZORIA COUNTY, TX AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

coastline. The work involved development of surge frequency curves at selected locations and the delineation of maps of areas subject to flooding from a 100-year hurricane. Results of the two studies by the COE differ with the results of this study mainly because the former studies were based on the synthesized Standard Project Hurricane Method as opposed to the Joint Probability Method used for this study.

A plan for drainage improvement is being developed by the Angleton Drainage District to improve the flow along Brushy Bayou and, at the same time, aim at breaking up the flow toward West Levee Ditch and Ditch No. 10. The SCS at Temple has developed backwater studies and peak discharges and is modifying the water-surface profiles for the flooding sources to match the high-water marks under current conditions. With this study, the SCS hopes to arrive at an estimation of the effects of floods on economic development.

In 1975 Landev Engineers, Inc., presented a study that presented approximate 100-year flood profiles along most of the major streams in the county (Reference 44). The data base of that study consisted of then-existing information collected from various governmental agencies, consulting engineering firms, and individuals.

Woodward-Clyde Consultants performed a wave overtopping analysis for the City of Freeport and determined that the Freeport levee system would protect the city from the coastal surge (Reference 55). The results of that analysis are in agreement with this study.

A Flood Insurance Study for the unincorporated areas of Matagorda County has been prepared (Reference 56). The results of this study are in exact agreement with the results of that study.

A Flood Insurance Study for the unincorporated areas of Fort Bend County has been prepared (Reference 14). A discrepancy occurs along Clear Creek because this study utilized a more up-to-date analyses. In addition, flood hazard data for the Brazos River do not match exactly because the analysis for this study is dissimilar to and more current than that for Fort Bend County.

Flood Insurance Studies for the unincorporated areas of Harris County and the City of Houston have been prepared (References 39 and 40). Those studies do not match this study along Clear Creek due to adjustments made to the analyses to account for land subsidence between 1973 and 1979.

A Flood Insurance Study for the unincorporated areas of Galveston County has been prepared (Reference 57). The results of this study are in agreement with the Galveston study except for the analysis along Halls Bayou. A floodway was not delineated for Halls Bayou in Galveston County.

Due to its more up-to-date nature, this study supersedes the previous Flood Insurance Studies for the unincorporated areas of Brazoria County; and the Cities of Alvin, Angleton, Freeport, and Liverpool (References 45, 46, 47, 48, and 49).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Federal Regional Center, 800 North Loop 288, Denton, Texas 76201-3698.

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EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1-30	30	51.20[1]	From intersection of Cottingham Road and Schurmier Road, proceed 0.48 mile west on Schurmier Road to station site 26.2 feet north of Schurmier Road centerline, railroad spike in utility pole marked with COE witness post sign.
RM 1-35	35	47.76[1]	Station site at Mykawa Road bridge crossing Clear Creek. Disk 1.0 foot west of northeast bridge corner, 84.1 feet north of Harris County Flood Control Disk on southeast corner of bridge, and 23.6 feet east of northwest corner of bridge.
RM 2-35	35	48.28[1]	From intersection of Halik Road and State Route 35, approximately 0.3 mile west on Halik Road to station site 32.3 feet east of easternmost rail of Atchison Topeka and Sante Fe Railway tracks, disk in concrete pillar 29.7 feet west of tombstone, 11.4 feet northeast of telephone pole, and 2.5 feet southeast of witness post.
RM 3-35	35	49.69[1]	From intersection of State Route 35 and FM 518, 0.1 mile west on FM 518 to station site 91.4 feet south of centerline disk in concrete pillar, 1.2 feet northwest of witness post, 50 feet southeast of telephone pole, and 15 feet southeast of wooden pole.
RM 1-45	45	46.27[1]	USC&GS disk, set in top of concrete post projecting 4 inches above ground, 60 feet southeast of southeast corner of Atchison, Topeka & Santa Fe Railway trestle over Mary's Creek, 0.8 mile south along railway from station at Pearland.

[1]NGVD of 1929; 1973 releveling

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1-65	65	41.19[1]	Disk set in concrete, flush with ground level, on south side of FM 518, from its intersection with Dixie Farm Road, west approximately 0.74 mile on FM 518.
RM 2-65	65	33.02[1]	At intersection of FM 518 and Winding Road, chiseled square in southeast corner of concrete post, 65 feet northwest of intersection, 14 feet southeast of sign, at entrance of Village Creek Housing Development.
RM 1-110	110	55.61[2]	USC&GS disk, set in top of concrete post level with County Route 190, 4.0 miles west along Atchison, Topeka & Santa Fe Railway from FM 1128 (Masters Street) crossing in Manvel, 30 feet north of centerline of County Route 190, 8 feet west of telephone pole.
RM 1-130	130	56.55	At crossing of Atchison, Topeka & Santa Fe Railway and FM 1128, 8.7 feet northwest of milepost 36, 43.2 feet south of south rail of main track, 15 feet east of centerline of paved road, and in top of north side of concrete signal light base.
RM 1-145	145	39.50	0.6 mile northeast along County Route 172 (Rosharon Road) from FM 1462 intersection, 6 feet southwest of power pole, 3 feet northeast of witness post, set in top of concrete post 0.8 foot below top of ground. NGVD designation: V693.
RM 1-165	165	49.15	One block south of Atchison, Topeka & Sante Fe Railway along Business State Route 35/State Route 409 (Gordon Street), at intersection with Sealy Street set vertically in west face of brick building, 30.5 feet east of centerline of road, 1 foot north of southwest corner, and approximately 4 feet above level of sidewalk. NGVD designation: 253.

[1]NGVD of 1929; 1973 releveling
[2]NGVD of 1929; 1979 releveling

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 2-165	165	29.28[1]	NGS disk, set in top of concrete post projecting 7 inches from ground, 2.54 miles southwest along Missouri Pacific Railroad from northwest apex of triangle formed by junction of Atchison, Topeka & Santa Fe Railway, 12.6 feet northwest of milepost 341, inches from witness post.
RM 1-175	175	41.06	0.95 mile north along Business State Route 35/State Route 409 (Gordon Street), from Atchison, Topeka & Santa Fe Railway, 48 feet west of centerline of road, set in center of top of west concrete headwall of concrete culvert, 37 feet northwest of northeast corner of building, and approximately level with road. NGVD designation: R1184.
RM 1-225	225	71.89[1]	NGS disk, set in top of south corner of truck scales foundation, 0.1 mile southeast along State Route 36 from junction of Mulcahy Street at Damon, 25 feet south of south corner of truck scales office building.
RM 1-295	295	19.23[1]	NGS disk, set on top of 5/8-inch copper coated rod encased in concrete post projecting 2 inches above ground, at Liverpool 200 feet along Missouri Pacific Railroad near crossing of Main Street, 102 feet north of north corner of brick garage at 2210 Main Street, 1.0 foot northeast of witness post.
RM 2-295	295	26.93[1]	NGS disk set on top of 5/8-inch copper coated rod enclosed in concrete post along Missouri Pacific Railroad at crossing of Main Street, located approximately 69.0 feet southeast of southwest rail of main track 41.5 feet southwest of centerline of street, 102.5 feet north of north corner of brick garage attached to brick house No. 2210 Main Street, 1.5 feet northwest of power pole bearing street light, and 1.0 foot northeast of witness post.

[1]NGVD of 1929; 1979 releveling

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1-395	395	30.69[1]	NGS disk, set in top of northwest end of northeast concrete headwall of double pipe culvert at north corner of junction of State Route 36 and 16th Street in West Columbia.
RM 1-445	445	29.11[1]	At Angleton, at northeast corner of junction of Velasco Street (State Route 288) and Locust Street, at south side of Brazoria County Courthouse, Coast and Geodetic Survey disk in top of south side of circular concrete foundation of steel flag pole, 44.0 feet north of north curb of Locust Street, 187.0 feet east of east curb of Velasco Street, 31.2 feet south of center of bottom concrete step of south entrance to courthouse, 1 foot south of flagpole, approximately 0.5 foot higher than streets and 0.4 foot above ground.
RM 1-455	455	22.59	At Danbury, 0.15 mile southwest along Fifth Street (County Route 171) from junction of Main Street, approximately midway between South Avenue G and South Avenue H, 44 feet northwest of centerline of Fifth Street, 100 feet southwest of centerline of South Avenue G, 1.2 feet northeast of east corner of cyclone fence around Southwestern Bell Telephone Company brick building 1.4 feet southwest of centerline of private driveway, 8.5 feet southeast of 40-inch tree, 67.1 feet northeast of east corner of Telephone Building, approximately level with street, disk on top of 5/8-inch copper coated rod driven to gradual refusal to depth of 40 feet. Upper portion of rod is encased in concrete post flush with ground. Reference mark is stamped B120G.

[1]NGVD of 1929; 1979 releveling

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1-565	565	35.19[1]	NGS disk, set on top of 5/8-inch copper rod encased in concrete post flush with ground, 140 feet southwest of intersection of Main Street and Avenue A, 27 feet north of north rail of Missouri Pacific Railroad main track.
RM 1-590	590	29.37[1]	NGS disk, set in top of 5/8-inch copper rod, at crossing of Missouri Pacific Railroad and State Route 36, 131 feet east of centerline of State Route 36, 1.5 feet east of telephone pole No. E33.
RM 1-610	610	14.42[1]	3.55 miles northwest along Missouri Pacific Railroad from crossing of Main Street at Clute, 8.5 pole south of mile pole 6, 0.3 mile north of junction of FM 2004, directly opposite wooden railroad trestle, in top and 1.9 feet east of west end of north concrete abutment of County Route 288 bridge over Bastrop Bayou, 16.5 feet west of centerline of road, 100.1 feet west of west rail, and approximately 2.5 feet lower than road; standard tablet stamped K 1143 1959.
RM 1-620	620	15.73[1]	2.4 miles northwest along Missouri Pacific Railroad from crossing of Main Street at Clute, 13.75 poles southeast of milepost 7, at west corner of junction of County Road 288 (Old Angleton Road) and Willow Drive, 106.1 feet southwest and across County Road 288 (Old Angleton Road) from southwest rail of main track, 35 feet southwest of centerline of road, 72.5 feet northwest of centerline of drive, 23.7 feet northwest of fence corner post, 0.7 foot southwest of 1-inch iron pipe supporting UNITED METHODIST CHURCH sign, 1.0 foot northeast of fence, approximately level with road, disk on top of 3-inch iron pipe flush with ground. Note: portion of disk is cut off but is still solid. Rod was held on high point during 1973 releveling. Note: tree mark AE is located in southwest root of 25-inch pecan tree, 13.5 feet south-southeast of mark. Standard tablet stamped L 1143 1959.

[1]NGVD of 1929; 1979 releveling

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 2-620	620	19.57[1]	2.4 miles northwest along Missouri Pacific Railroad from crossing of Main Street at Clute, 0.1 mile southwest along Willow Drive, at crossing of steel tower southeast of Lake Jackson Substation, 175 feet northwest of centerline of drive, 1.0 foot west of east corner of concrete base, approximately 2 feet lower than drive, 2.5 feet above ground; standard tablet stamped S 1206 1973.
RM 3-620	620	16.77[1]	1.55 miles northwest along Missouri Pacific Railroad from crossing of Main Street at Clute, 0.15 mile northwest of junction of College Boulevard, 9 poles southeast of milepost 8, directly opposite wooden railroad trestle, in top and 1.2 feet northeast of southwest end of northwest concrete abutment of County Route 288 (Old Angleton Road) bridge over Oyster Creek, 90.3 feet southwest and across road from southwest rail, 16 feet southwest of centerline of road, and approximately 2.5 feet lower than road; standard tablet stamped D 1143 1959.
RM 4-620	620	15.15[1]	NGS disk set in top of copper-coated steel rod, located 0.6 mile northwest along State Route 288 from crossing at Main Street, at crossing of private shell road, 49 feet northeast of northeast rail of Missouri Pacific Railroad, 9 feet southeast of James Street centerline extended, 2 feet northwest of power pole, 51 feet west of fence line, 2 feet southeast of witness post, 23 feet southwest of centerline of shell road, 4 rails southeast of milepost 9, 3 feet below railroad tracks, approximately level with shell road.

[1]NGVD of 1929; 1979 releveling

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 5-620	620	10.02[1]	USC&GS disk set in top of concrete post flush with ground, along Missouri Pacific Railroad at Main Street crossing, 29.0 feet northeast of northeast rail, 65.5 feet northwest of centerline of street, 48.0 feet north and across tracks from center of switch stand, 31.5 feet southwest of centerline of driveway, 9.5 feet northwest of telephone pole with guy wire anchor, 1.0 foot southeast of witness post, approximately 5 feet lower than tracks.
RM 6-620	620	9.85[1]	NGS bench mark, N 753 RESET 1959, set in top of east concrete headwall of culvert on State Route 288, 0.45 mile southeast along Missouri Pacific Railroad from crossing at Main Street, 73.5 feet southwest of southwest rail, 26.0 feet east of centerline of east bound lanes of highway, 1.2 feet north of south end of headwall.
RM 7-620	620	7.46[1]	NGS disk set in top of west corner of concrete base of west steel leg of tower 214 of power transmission line crossing, 0.3 mile south along State Route 288 from crossing at Missouri Pacific Railroad, 104.0 feet east of centerline of east bound lanes of highway, approximately 2 feet lower than pavement.
RM 1-640	640	6.00	3.0 miles northeast of Oyster Creek, along old Highway No. 288, now FM 523, on low mound approximately 20 feet east of east right-of-way line of highway, approximately 0.7 mile south of railroad crossing in west edge of large pasture. Standard triangulation disk stamped PHARR 2 1956 in concrete post flush with surface of ground. It is 2 feet from 4 x 4 post.

[1]NGVD of 1929; 1979 releveling

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 2-640	640	7.21[1]	NGS disk, set in top of north end of east concrete headwall of 4 foot concrete box culvert, at junction of FM 523 and County Route 792, 28.5 feet east of centerline of FM 523, 1 foot higher than road.
RM 3-640	640	13.79[1]	USC&GS disk, set in top of north end of west concrete curb of FM 523 concrete bridge over Oyster Creek, 14 feet west of centerline of FM 523, 1 foot higher than road.
RM 1-675	675	3.68[1]	USC&GS disk, set on top of copper rod, 0.5 mile southwest along County Route 257 from southwest end of San Luis Pass bridge, 7 feet south of power pole No. P30, 2 feet north of witness post, 1 foot below road.
RM 1-755	755	15.83[1]	Standard NGS disk, stamped S 586 1942, set in headwall of culvert under State Route 36 near intersection of County Route 304, 42 feet northeast of centerline of State Route 36 and 56 feet northwest of centerline of County Route 304.
RM 2-755	755	12.91[1]	Standard NGS disk, stamped C 1273 1978, set on top of copper coated steel rod encased in pipe, 37 feet south of centerline of east bound lane of State Route 36, located 0.8 foot north of corner of chain link fence, 41 feet west of car wash entrance and 300 feet south of Jones Creek Supermarket.
RM 1-760	760	14.73[1]	USC&GS disk stamped V586 1942, set in top of south end of west abutment of State Route 36 drawbridge over the Brazos River, 18.5 feet south of centerline of State Route 36, 2 feet below level of highway.

[1]NGVD of 1929; 1979 releveling

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1-780	780	3.96[1]	NGS disk, set in top of northwest end of northeast concrete headwall of 30-inch pipe culvert under FM 523, 0.6 mile northeast of junction of State Route 332, at junction of Jeffers Road to Oyster Creek, 22 feet northeast of centerline of Jeffers Road.
RM 2-780	780	4.21[1]	NGS disk set in center of V-shaped multi-boxed culvert level with concrete headwall at Brazosport High School, 19 feet north of centerline of west bound lane of State Route 36, 2 feet below road.
RM 3-780	780	7.67[1]	USC&GS disk, set vertically in west face of brick building at southeast corner of intersection of Second and East Park Streets in Freeport, 15 feet east of east curb of East Park Street.
RM 1-785	785	14.25[1]	USC&GS disk, set in top of concrete post flush with ground, 0.6 mile southwest along West Dow Barge Canal Levee Road, 95 feet south-southwest of power pole 91, 13 feet west of centerline of access road.
RM 2-785	785	5.85[1]	USC&GS disk, set in top of concrete post projecting 3 inches above ground, 0.1 mile northeast along Bluewater Highway from junction with State Route 332, 91 feet southeast of centerline of road, 28 feet southeast of fence line, 2 feet from witness post.
RM 3-785	785	4.16[1]	USC&GS disk, set in top of concrete post level with Bluewater Highway to its junction with Twelfth Street, 53 feet southeast of centerline of Bluewater Highway, 4 feet northeast of witness post.

[1]NGVD of 1929; 1979 releveling

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1-795	795	3.48[1]	Coastal tidal mark disk approximately 1,100 feet south of T-intersection of Lamar Street and Eighth Street.
RM 2-795	795	5.76[1]	USC&GS disk, set in top of center of concrete jetty along northeast side of Freeport Harbor Channel, 555 feet southeast of southeast side of Jellies Bait Camp building, 104 feet southeast of bench mark 15.00.

[1]NGVD of 1929; 1979 releveling